Class 504 Book A82
General Theological Seminary Library
CHELSEA SQUARE. NEW YORK

The Interpretation of Nature

Digitized by the Internet Archive
in 2026

https://archive.org/details/theinterpretatio0000cllo

The Interpretation of Nature

By

C. Lloyd Morgan, LL.D., F.R.S.

CAN THE COMMONS LIBRARY NEW YORK

G. P. Putnam's Sons
New York and London
The Knickerbocker Press
1906

BD
581
.M67
1906

69516

Copyright, 1906
by
C. Lloyd Morgan

CAN THEOL SEMINARY
LIBRARY
NEW YORK

The Knickerbocker Press, New York

PREFACE

THE Interpretation of Nature formed the subject of a course of Lowell Lectures which I had the honour of delivering in Boston last year, and of an article in the May number of the *Contemporary Review*. Of that article this little book is an expansion. I have introduced a few passages from a series of papers which appeared in the *Monist* in 1897 and succeeding years, and have utilised, in Section X., parts of an Address given at the International Congress of Arts and Science during the St. Louis Exposition. Were so small a volume worthy of such an inscription I would dedicate it to my many American friends, to whose kindness and courtesy I owe so much.

C. Lloyd Morgan.

Bristol, September, 1905.

CONTENTS

CHAPTER		PAGE
	PREFACE	iii
I.	DIVERSE INTERPRETATIONS . . .	1
II.	PURPOSE AND NATURALISM . . .	12
III.	THE REALITIES OF EXPERIENCE . .	24
IV.	AN HISTORICAL CONTROVERSY . . .	35
V.	THE IDEAL CONSTRUCTION OF NATURALISM	46
VI.	THE WEB OF CAUSATION	66
VII.	THE PROBLEM OF LIFE	79
VIII.	MIND AND MECHANISM	94
IX.	THE SCIENCE OF METAPHYSICS OF WILL .	105
X.	GENETIC PSYCHOLOGY	123
XI.	THE METAPHYSICAL POSTULATE . .	158
XII.	DETERMINISM AND PURPOSE . . .	172

The Interpretation of Nature

I

DIVERSE INTERPRETATIONS

AN interpreter, I take it, is one whose business it is to disclose or unfold meaning. In the commonest use of the word he is one who translates for us what is expressed in a language which we do not understand. The hieroglyphics of Egypt were for long a sealed book until the Rosetta stone afforded a clue to their interpretation. When a passage in some old author is obscure we call in a scholar to interpret its meaning for us. Although in this case we partially understand the passage, we feel that more remains behind: some touch of insight, some delicate turn of thought, which needs an illuminating ray of deeper penetration to reveal and make clear to our duller perception a value which we have failed to grasp. Here then we have not only meaning for the intellect, but worth for our æsthetic appreciation of beauty in thought or expression. To the man of artistic temperament, the truest and best interpreta-

tion is that which discloses with the greatest richness and subtlety the fundamental harmonies of the subject with which it deals. Thus in the realm of music the worthy interpreter is the executant who can most adequately bring home to us the wealth of majestic or tender feeling which a Beethoven or a Brahms has bequeathed to the world; and in the dramatic sphere the interpretative skill of the actor is seen in his power of revealing hidden depths of pathos or of humour in the character whose part he plays. But there is yet another aspect of the interpreter's office —the end or purpose of the communication. Of old, dreams were regarded as messages sent to warn or to incite to action; and we read that "Pharaoh told his dreams, but there was none that could interpret them unto him." Here is the message; but for what purpose is it sent?

These elementary considerations serve to disclose the threefold character of interpretation in relation to the affairs of human life: first, in terms of meaning within the sphere of knowledge; secondly, in terms of æsthetic appeal within the sphere of emotion; thirdly, in terms of end within the sphere of purpose.

We shall probably all agree that the interpretation of nature is the disclosing or unfolding of its hidden

meaning. But meaning in what sense? For the artist as such and the man of science as such, and again the theologian as such, the emphasis will differ. To the artist the æsthetic appeal will predominate; to the man of science the appeal will be primarily intellectual; to the theologian the central note is that of purpose or design. I think we may say that for the average man of general culture, an interpretation of nature which combines all three elements is alone satisfying.

We often have occasion to notice how the average man of general culture, not specially versed in the methods of science, accepts the explanations of, let us say, the biologist with a characteristic teleological bias. He will cordially agree that no adequate interpretation of the colours, markings, and forms of certain insects could be reached until the advantage of protective resemblance, or of mimicry, had been established. But press him to give some expansion to his view of the matter, and you will probably find that he will explain protective resemblance in terms of purpose. He will say that it is developed so as to enable the insect to remain hidden from the birds or other animals which would prey upon it. That, from his predominantly teleological point of view, is the end for which protective resemblance has been de-

veloped. In strictness, however, the scientific explanation of protective resemblance is given in reference, not to its teleological end, but to its mode of origin. Here is an insect which exhibits such resemblance, say, to a leaf or stick. How did it originate? It exists because the insect inherits the form and markings of its parents, which, through the possession of such form and markings, remained hidden and thus survived, while others, more conspicuous to their captors, were destroyed and left no offspring. The resemblance is interpreted as the result of certain foregoing circumstances and conditions. The insect escapes because it has such form and markings; it was not given protective resemblance in order that it might escape. This retrospective outlook towards antecedent conditions is characteristic of the scientific attitude, the prospective attitude being that of expectation of what will be the sequel to present conditions. Thus the geologist interprets scenery, not as that the purpose of which is to appeal to our sense of beauty or grandeur, but in terms of foregoing denudation. He explains the mode of origin of narrow or spacious valleys, of craggy heights or rounded hills, of bay and promontory, headland and fiord, as the result of the fretting of streams, the persistent influence of rain, the effects of frost, the dash of sea

waves, or the grinding action of glaciers on rocks of differing hardness or resisting power. The botanist explains the gorgeous tints of autumn as an incident in the waning vitality of the forest trees when the warmth of summer gives place to the chill of early winter frosts. Each interprets the phenomena in terms of those circumstances and conditions to which he applies the term causation.

To say that the man in the street is uninfluenced by the scientific interpretation of nature which leads onward to naturalism would be to say that he is out of touch with the tendencies of his age. This is just what he is not, as I conceive him. He is a very chameleon in his sensitiveness to varied intellectual, æsthetic, and religious or quasi-religious influences. But just for this very reason he does not take his colour from science alone. And I do not think I am far wrong in assuming that the interpretation of nature which most strongly appeals to him is one that combines the three modes I have distinguished. In support of this view I would adduce as unbiased evidence the testimony of the publisher who puts on the market a pretty constant supply of that kind of literature of which the man in the street will show his appreciation by purchase.

There is a class of book, at present much in vogue,

so much so as to afford a fair indication of what most strongly appeals to the average man, wherein are to be found pleasing descriptions of nature in garden, field, and hedgerow, at the pond side, by the seashore, in woodland glade, or on the undulating moorland tract watered by mists and copious dews. Delicate word-pictures and artistic illustrators conjure up before our eyes the chestnut in its glory of summer bloom, the autumn tints of beech and elm, the meadows golden with buttercups, the orchard laden with ripening fruit, the blackbird pouring forth his full rich notes, the little brown wren slipping in and out among the hedge sprays, the hovering kestrel or the soaring lark, the badger in his lair, the water-vole beneath the stream's overhanging bank, the dragon-fly darting over the rushes, the whirligig beetles in their mazy dance, the murmur of innumerable bees, and all the varied life of the countryside. One of their leading aims is to help us to see what we should otherwise pass unnoticed, to stimulate our interest, and, if it may be, to charm us by the fidelity of their reproduction of scenes associated with hours of relaxation. But they also skilfully utilise some of the facts and theories established by science. Geology, botany, zoölogy are laid under contribution; even physics and chemistry are administered in small

doses. But for the most part only such admixture of science is tolerated as shall serve to heighten the general effect, or, to put it in another way, the science is subsidiary and contributory to an interpretation which is not meant to be primarily scientific. Furthermore, a subdued note of purpose is generally present and is welcomed by the average man. Indeed, it is scarcely too much to say that for him it is the evidence of design in natural events which bestows on nature-study its central interest and its abiding value. These works serve therefore to exemplify what I have spoken of as the threefold appeal to the plain man.

For him, too, and for the modes of thought and expression which he represents, nature-study and natural science do not include the works of man, still less his mental attributes and his intellectual faculties. The distinction between natural and human products is accepted as an obvious and satisfactory basis of classification. Hence arises an *imperium in imperio*, a world of art in the midst of the world of nature. I am not sure that the average man thinks out very clearly the relations of the two empires; partly because the distinction is to him so familiar and obvious as to render it scarcely worth while to delimit the territories in any formal manner. He

may not find it easy in all cases to say where and how and to what extent human purpose is impressed upon the natural world; but just in so far as that purpose does modify things and events have we the products of human art or artifice.

Such I conceive to be the outlook of the plain man in approaching the interpretation of nature. Different in two cardinal respects is the outlook of those who accept the teachings of modern naturalism. In the first place, man is regarded as a product of natural evolution—a highly specialised product no doubt, but still, body and mind, of natural origin. It is, they will say, sometimes convenient to regard natural products and human or artificial products as belonging to different categories. But it is none the less incontestable that for scientific treatment this is exceedingly inconvenient. Just in so far as man does modify things and events, is he thereby shown to be part of the conditions and circumstances under which such modification occurs. And though it may be obviously convenient to distinguish the links on the one side from those on the other side of this, to us, the central human link, still from a broad and comprehensive point of view we should seek to include all the causal relations of the chain as a whole.

The supernatural interpretation of mental and

spiritual phenomena, the exponent of naturalism will urge, is a relic of the days before psychology was recognised as a science working hand in hand with physiology. It is true that psychology is not commonly placed in the category of the natural sciences, and that no one could claim for it a place among the physical sciences. It is true that the chemist, the astronomer, the geologist, in their several contributions to the interpretation of nature, wisely take for granted the conscious and intellectual operations by which their results are reached. They assume, and they are quite right in assuming, a frankly objective standpoint. They extract from data somehow presented to the mind the laws of phenomena somehow elaborated by the mind. How presented and how elaborated it is not their special province to determine. But from a broad and catholic point of view we should not restrict the interpretation of nature to the contributions of any particular science, nor to those of any limited group of sciences. The real questions are these: Are the phenomena of consciousness itself closely and intimately related to the phenomena, such as physical events, which are presented in or to consciousness? Are mental products and processes subject to complete interpretation in terms of antecedence and sequence, or in other words

are they open to scientific investigation? Granting that an affirmative answer is given, as naturalism asserts that it must be given, to these two questions, are there valid reasons for excluding the phenomena of consciousness from the category of natural occurrences? Naturalism is fully convinced that there are no such reasons; and its logical exponent is bound to urge that our conception of nature should be so far extended as to include those phenomena of consciousness, of which we see or infer the beginnings in the lower animals and the present culmination in mankind. Man is thus part of that nature which we endeavour to interpret on the basis of scientific study. As this is one of the contentions with which we shall be concerned, it may be well to distinguish two forms which it may assume: (1) Man forms part of the naturalistic universe of discourse; (2) within that universe is to be found a complete interpretation of all human aspiration and endeavour.

In the second place, naturalism is at variance with popular thought in its attitude towards purpose. This is regarded as a product of evolution; whereas the average man regards it as that which directs the evolutionary process. The contention is that there is sufficient evidence of purpose in the sphere of human life and endeavour, and that its natural genesis

has to be explained; but of purpose in the realm of nature, beyond the sphere of human influence, there is not sufficient evidence. Here again it may be well to distinguish two forms which this contention may assume: (1) Purpose in nature—if such there be—falls outside the naturalistic universe of discourse; (2) such a conception is therefore inadmissible. It is a picturesque relic of the childhood of our race.

We have here what may, I think, be regarded as the radical and fundamental distinction between two opposing and often strongly antagonistic modes of interpreting nature. On the one hand, the human mind, will, purpose, is taken as the basis of interpretation, and in such terms is the meaning of nature explained. On the other hand, the phenomena of nature, as formulated by science, afford, it is said, the only valid foundations on which we can securely build, and in such terms is the human mind itself explained. In the one case, the course of procedure is from within outwards, until all nature is pervaded by mind analogous to that which interprets. In the other case, the course of procedure is from without inwards, until the mind is explained as the product of molecular motion of a peculiar and exceedingly intricate kind. Let us briefly trace the origin of these two types of interpretation.

II

PURPOSE AND NATURALISM

THERE can be little doubt that among primitive folk the conception of purpose would be freely employed in all matters of social life and intercourse, and in this connection would stand in no need of explanation, since it is that in terms of which explanations are themselves given. A's purposes are related to B's purposes; sometimes they run parallel or converge to a given end; often they run counter or diverge; and neither A nor B has the smallest hesitation in referring his neighbour's deeds to purposes like those by which he is actuated. This requires neither explanation nor logical justification; it is naively accepted as part of the given conditions of tribal life. But there are other actions—natural occurrences as we call them—which also in like manner aid or frustrate his own endeavours. Must not they, too, be expressions of a purpose or purposes? Just in so far as they have any meaning, that assuredly for him is their meaning. Familiar events,

the orderly processes of nature, are by such people accepted as they come; there is no need of interpretation. And so far as any such need is dimly felt, the interpretation is always in relation to human endeavour. In early ages and for primitive folk, the meaning of this earth was, to be the home of man; the sun and moon existed to give him light or to mark his times and seasons. Bird and beast, flower, shrub and tree, directly or indirectly, ministered to his needs, and afforded him food or shelter. This was their end or purpose as seen from the brighter side. But there was also the darker side. The earth which was his home presented also obstacles to the attainment of his wishes. From the same sky which gave him warmth and radiance came the lightning flash and thunderbolt. The lion and the wolf were the appointed enemies of his race and ravishers of his flocks and herds. Among the plants or trees with wholesome fruits were bushes with noxious berries. All, however, so far as interpreted at all, was, at this stage of thought, interpreted in terms of meaning directly or indirectly centred in man. Not indeed centred wholly in the individual; for man is a social being; he has friends and enemies; he is a member of a tribe at variance with other tribes. The darkening of the moon during an eclipse no doubt forbodes dis-

aster; but the impending disaster may fall on friend or foe. An interpreter was needed to read the sign and to indicate what is thereby signified. Hence arose the medicine man and the astrologer, who were specialists in such matters.

But as these events were more fully studied by a class of the community specially set aside for their interpretation, they were seen to be interconnected among themselves as well as connected with man's life and struggle in the world and with his foes. Herein lay the germs of that distinction between diverse interpretations which still contend for predominance —on the one hand the interpretation in terms of purpose, on the other hand that in terms of natural law. But sharp and well-defined as this distinction has grown in these our latter days, at first it only implied somewhat diverse aspects of a continuous line of advance. The observed interconnection among phenomena served chiefly to show how subtle, and how wide in range, was the influence of natural events on human destiny. This may be seen in the close relations which obtained between astrology and astronomy.

The early interpretation of nature, when the initial stages of unification of natural events had been reached, was not only anthropocentric but geocentric.

The earth was the stable pivot of a universe the conception of which was taking form in the minds of men—the central point around which sun, moon, planets, and otherwise fixed stars circled in courses which seemed part of the abiding constitution of things. But they were still regarded as fulfilling a purpose. Astronomy, beginning to interpret in terms of natural law, was still closely linked with astrology, interpreting in terms of the earlier conceptions of meaning. The constellations exercised a subtle influence, malign or favouring, on human life —an influence which the astrologer alone could rightly interpret. The sun, moon, and five known planets, for example, influenced in turn the successive hours of the day and night; and after the one which, so to speak, had charge of the first hour, the day was called. Our weekday names are thus a legacy bequeathed to us by astrology. But it was an astrology containing the germs, or more than the germs, of a scientific knowledge which had already been attained, it is said, not less than four thousand years before Christ. For the order of influence was the order of orbital sweep; and (interchanging the Sun and Earth in accordance with the geocentric conception) this order was already known correctly—Saturn, Jupiter, Mars, the Sun, Venus, Mercury, the Moon. Now

Saturn, with amplest sweep, influences the first hour of the first day, giving it his name—Saturday. The others in due order cast their spell over the succeeding hours, so that, as there are seven in all, Saturn again influences the eighth, fifteenth, and twenty-second hours, Jupiter the twenty-third, Mars the twenty-fourth, and the Sun the first hour of the next day, giving us Sunday. The Sun again influences the eighth, fifteenth, and twenty-second hours, Venus the twenty-third, Mercury the twenty-fourth, and the Moon the first hour of Monday. We thus get a clue to the order of succession; for the Sun is third in sequence after Saturn; the Moon third in sequence after the Sun. Applying this rule of succession to the list of luminaries, we have in due order the remaining days of the week—Mardi (Tuesday), Mercredi (Wednesday), Jeudi (Thursday), and Vendredi (Friday).

Now whether the study of planetary orbits was undertaken chiefly for an astrological purpose, or also, as is probable, for other and what seem to us more practical applications (but still, be it noted, for the purposes of human endeavour), we have here the beginnings (and more than the beginnings) of what we should now term scientific knowledge—of interpretation in terms of natural law. Science may,

indeed, be said to have arisen as the middle term between the gaining of direct experience and its application to the varied needs of human life. So far as we know, man stands alone as interpreter of nature in this or in any other sense. The dumb beasts, with wonderful sagacity, utilise experience for the guidance of behaviour to practical ends. But for them the middle term, even if it can be said to exist with any definiteness, does not disengage itself from sensory experience on the one hand, and the resulting behaviour on the other hand. Man alone seeks to explain; to analyse experience into its elements, and to rebuild these elements in the systematic unity of a scheme of thought; to read particular events in the light of general conceptions. These general conceptions enter into the framework of scientific knowledge. Every branch of science, involving broad generalisations from observed facts, arose in close touch with those human needs to which it could be applied. The end was essentially practical, or in any case purposive, with a distinct bearing on some special phase of human well-being. But as the middle term grew in importance and became an independent centre of human interest it ceased to be regarded only as a means of human ends; or, rather, it may be said to have been raised to the level of an

end in and for itself. The knowledge gained in different fields was brought into relation; it was slowly organised into a consistent whole; it received a new application, still indeed in accordance with human needs—the intellectual needs of the inquiring spirit—but related to these needs in a new way. The interpretation of nature in and for itself took shape as a worthy intellectual aim, but ever more and more in intellectual detachment from all other feelings and wishes and yearnings of the human heart. This is the interpretation in terms of natural law which tends in some degree to supplant the interpretation in terms of purpose. Each has its advocates; and each has progressively reached a higher level of refinement. Step by step and stage by stage have these two aspects of a philosophy of nature striven towards increasing range, unity, and universality, culminating in the opposing conceptions of theism and naturalism. The former may have begun by uncritically projecting human purpose on to the plane of nature; but as it became more refined the redundant crudities were removed. Many of those who still accept this explanation of the meaning of nature regard the world as an expression of purpose in relation to that of man, but freed from human imperfections and limitations, no longer capricious but the type of

steadfast and beneficent influence; a purpose without variableness or shadow of turning, of which indeed we can only aspire to an imperfect and limited comprehension, but in relation to which human life attains its highest worth; a purpose which is the source of all that is revealed to us through the channels of human experience, and one which appeals not less, nay, more, to the poet and the artist than to the man of science and the philosopher. On the other hand, as we have seen, the procedure of naturalism has taken an opposite course. Instead of projecting purpose on to the plane of nature it has introjected the mechanical explanations of the external world into the life and eventually into the very soul of man. This type of interpretation was first applied to what we may term the inorganic periphery of natural knowledge in the starry heavens. By successive steps, however, it worked inwards towards the human centre. Man's bodily frame and its physiological functions were, in due time, interpreted in mechanical terms. His conscious experience, regarded as a by-product of the processes occurring in some part of the brain, indirectly if not directly yields to a like method of analytic treatment. The central citadel of the soul is captured. And the newer method of interpretation, according to its most advanced exponents,

is now, at least in its broad outlines, complete, and human purpose itself is explained as the conscious accompaniment of nerve-changes explicable in terms of a mechanism resulting from a prolonged process of rigidly determinate evolution.

But while naturalism thus finds its principle of unification in the universality and interconnection of world-events, while it works inwards from external nature to the life and mind of man which it interprets as expressions of natural law, it meets with strenuous antagonism from the opposing school of thought. The attempt to depose this earth of ours, as the home of man, from its central position in the solar system not only showed an impious disregard of the teachings of the Bible, it was regarded as the first naturalistic attack on the system of interpretation therein set forth. It was resisted with all the force which ecclesiastical authority could summon to its aid. When Hutton and Lyell laid claim for naturalism on the physical features of the earth, and urged that the stratified deposits testify to a long-continued process of natural development and a progressive sequence of life-forms through a vast stretch of time reaching backwards for ages before the existence of man, the opposition again was decided and sincere. Apart from any contradiction of Holy Writ, how

could such a view be reconciled with the creation of the world that it might be the abode of man, and that it might subserve his ends and purposes. And before the feelings of antagonism to uniformitarian geology had subsided, comes Darwin, as the prince of evolutionists, showing how a doctrine of transformation could be accepted on purely naturalistic grounds, and boldly asserting that man and ape were cousins by descent. Many still living remember well with what vehement opposition this further encroachment of naturalism was met in the sixties of the last century. But as organic evolution gradually won its way to general acceptance, the opponents of naturalism withdrew to their central citadel, the mind and spirit of man. That at any rate was theirs to hold and to keep against all attacks. Naturalism, however, having gained strength and confidence, does not hesitate to lay siege to this citadel, and already regards the whole position as won. Determinate evolution is victorious all along the line. It only remains for us either to accept the inevitable, or to take up a position as belated outsiders, living in dreamland away from the practical realties of science, rethinking the childish thoughts of primitive folk, and seeking in vain for purpose in the heaven from which it has long ago been banished.

The much-vaunted triumph of naturalism is founded upon the assured conquests of science. No one to-day is likely to deny to science an honourable position in the world of thought. It has brought the most varied phenomena within the scope of an orderly scheme. When we look out on the world in which we live we are at first bewildered with the multiplicity of diverse happenings which meet our wondering and admiring view. At night we see the firmament bespangled with glittering points of light sweeping majestically in well-ordered array across the heavens as the earth rolls onwards in her course; among them are wandering points, the planets, threading their way among the fixed stars, and that larger, but yet smaller wanderer, the moon, waxing and waning as we watch her night by night. The stars fade in the brightening east, and the sun rises to trace its larger or smaller arc in the sky. Clouds form and are banked in billowy masses; wind and rain, thunder and lightning, present to us fresh aspects of nature. The rugged or gently swelling earth with its mountain and valley, hill and dale, waterfalls and fretting streams; the coast-line with its bays and promontories, its bounding expanse of ocean with rising and falling tide, with wavelets lapping the sands or breakers beating on the beach, add to our store of

observed facts. Tree and shrub, fern and flower, arrest our attention, while bird and beast and myriad insects speak to us of the wealth and variety of life. Men and women people the scene, living in complex communities, with strange customs, with experience, thought, and imagination, seeking to explain the varied phenomena of nature and how consciousness itself has appeared in their midst. Such is but a bird's-eye view of the varied facts with which science has essayed to deal. That it has been able to group them, systematise them, exhibit their multiplex interconnections, bring them to some extent within a single related scheme, and show running through them all the grand sweep of a curve of evolution, all this should fill us with a sense of unqualified admiration. Science has undertaken a worthy task, which it prosecutes with splendid ability. But when it erects upon such foundations a philosophy of naturalism, when it asserts that nature is devoid of purpose, and that even in human life purpose may be so explained as to be practically explained away, it behooves us to re-examine its data, to submit its conclusions to critical study, and to make sure, before we surrender ourselves to its agnostic creed, that there are no realities for human thought other than the realities of phenomenal existence.

III

THE REALITIES OF EXPERIENCE

HOW do we become acquainted with the world in which we live? and what are the realities in and for experience?

It might seem at first sight that these are questions which we could well afford to pass over. What does it matter, to those who wish to interpret nature, how we become acquainted with it? May we not leave to psychology the discussion of the manner in which the universe of things is mirrored in consciousness and how the images in the mirror are formed? We wish in the first instance, at any rate, to interpret the reality itself, not merely its presentment in consciousness. But what is the reality itself? If we reply that it is that which casts the image on the mirror, the question must still arise: How then do we get beyond the mirror so as to become acquainted with this reality?

Is it then necessary for the astronomer to preface his treatment of the solar system with an account

of the processes by which we become cognisant of the existence of the sun, moon, and planets? Is it requisite that the biologist should discuss the manner in which animals and plants are perceived through the channels of sense before he proceeds to deal with them under the conditions laid down by the methods of organic science? Must the chemist and the physicist render an account of how matter and energy enter into the field of consciousness before they lay before us their conclusions as to the molecular, atomic, and (one must now add) subatomic mechanics of the universe? By no means. Each science has its special field of work, and within that field takes certain preliminary facts as data—that is to say, it begins to build on a basis of common experience. None of the sciences which deal with what we may call departmental interpretations of nature need inquire into the manner in which the basal facts with which they are concerned are known (if indeed they are so known) as existences independent of the mental faculties of those who investigate them. But it is otherwise when the results won through such departmental study are organised into a complete whole. It is otherwise when we desire to reach a comprehensive explanation of nature in relation to man. For then the question must arise: What is nature? And

this is tantamount to an inquiry as to the manner in which we become acquainted with the world in which we live, so that we may thus disclose the order of reality with which we are concerned in the investigations of science. In other words, we have to examine the foundation of that common experience which the several departmental studies take for granted at the very outset of their researches. No doubt such inquiries open up questions which are regarded, and rightly regarded, as metaphysical. But they must be faced, especially if we are to consider the claims of what is known as naturalism to afford a valid interpretation of nature which shall satisfy all the needs of the inquiring mind. I revert then to the question: How do we become acquainted with the world in which we live?

Now the world is a somewhat unmanageable item to deal with as a whole. Let us therefore take a small sample. There is a rose-bud, tangible, delicately formed, sweet-scented, warm-tinted, out there on the table before me. Let that be our sample of the world as given in practical experience. I suppose we may agree that if, say, half a dozen common-sense people, who shall be our sample of mankind, see, touch, smell, and handle this little blossom, it is as real as any object of experience can possibly be

—the scent and colour as real as the size, shape, and resistance to the touch. Now each individual, when he sees it, has a visual impression or presentation. But the impression at once suggests that if we reach out our hands towards the rose-bud we can take it up, feel it, and touch it; or if it be out of reach we can walk towards it and then become further acquainted with its properties. And if we convey it to our noses we shall experience its fragrant scent. An impression which thus carries a suggestion of other modes of impression—which has meaning in terms of other kinds of experience—is raised to the level of perception. Thus the impression is a bit of experience and apart from other modes of experience gained in the same kind of way through the avenues of other senses it has no practical meaning for us. But for the six individuals the impressions are all different, since each person sees the rose-bud from a slightly different point of view. The impression or presentation answers to the image on the retina of the eye, and for no two persons can the image be quite the same. On the other hand, the meaning, the suggested or recalled part of the perception, is substantially the same for all six people. It is probably, however, not quite the same, since no two persons have quite the same experience even of a rose-bud. The

first point to be noticed then is that each of the six individuals has an impression which is suffused with meaning, that this is essentially a product within the field of his experience, and that apart from such perception there could be no presentational experience at all.

But men and women are social beings, and they require names by means of which they may label their experiences so that they may describe them and compare notes about them. I have applied the name "rose-bud" to the perception of any one of the six persons. But this is something that is given within the individual experience of the person who feels that he has it. For each several person it *is* a mental product. But not only for each is it a mental product; for each it *has* a corresponding reference. And it is to this *reference*, rather than to the individual mental product as such, that we give the name "rose-bud." The general term we apply to any such centre of reference is "object"; and studies in terms of such reference are "objective" studies.

At the risk of some repetition, we may ask: What then is an object? We all know the common use of this word for the well-known things we see around us—the writing-table, the letter-weight, the piano, the golden pippin, and so forth. These are objects

which directly appeal to our senses—objects of which we gain experience through impressions, and of which, without impressions, we can gain no direct and first-hand experience. Let us grant that the impression, as such, is a purely individual subjective state of consciousness. Is the word "object," as applied to any one of the things around us, only a different name for an impression? No, quite clearly it is not; a little consideration will show that it implies something more. The golden pippin which we see on the sideboard not only does afford a visual impression, but it can afford other impressions. We can touch it, lift it, smell it, bite it, taste it. The piano, now silent, can, if some one touches the keys, give us auditory impressions, or we can go to it and feel the peculiar cold smoothness of its polished case. And similarly with other objects of sense, each of which is a centre both of actual and possible impressions, the actual impression having meaning in terms of the others. The object then is a common centre of reference for a number of different kinds of impressions, and is thus independent of any given state of consciousness. And even the impressions of one kind, such as the visual impressions, of which the same object is the centre of reference, are very numerous, and depend on its distance and the way in

which, and the direction from which, it is illuminated, and so on; that is to say, it is related to our experience as a whole in terms of cross-reference. As we watch a yacht sail out of harbour, and visually pursue her course until she is a mere speck upon the horizon, the sight impressions undergo continuous change; but the yacht as an object, as a centre of reference independent of them severally, remains the same. And it is a common centre for my impressions and those of my neighbour—for the presentations of all those who are constituted as we are, and are the heirs to like modes of experience.

For the practical purposes of daily life, guidance is afforded by the correlation of the several fields of sensory reference—the visual field, the auditory field, the fields of touch, of smell, taste, temperature and so forth; and the field of motor activity, that which includes all those sensory impressions which afford information of the movements of our limbs and bodies. Through this correlation experience becomes an organised whole, and the data from the several fields are brought to bear on the conduct of life. Presentations of all sorts get their value in relation to our practical needs. And for these ends all are equally real and valid as given in experience. But when our aim is the interpretation of nature, as the

objective reference of all such experience, it has been found convenient to regroup the data for the purposes of scientific study. Thus we have the facts of experience which fall under astronomy, geology, chemistry, physics, and so forth. And with this regrouping is associated a detachment from the immediate purposes of practical life at any rate so far as concerns what is spoken of as pure science—the aim of applied science being a re-attachment of the results of the inquiries of specialists to our industrial needs and requirements. But, in all the sciences above named, matter in motion plays a part; while in all mental science physiological changes, themselves susceptible of interpretation in terms of matter and motion, are at all events accompanying phenomena. Since this is so (and such is the claim of naturalism), all these modes of experience are directly or indirectly interpretable in terms of matter and motion—in terms of mechanism. Now where exact mathematical treatment is desirable it is obviously convenient—nay, more, it may be necessary—to translate divers kinds of experience into the terms of that category which is most completely susceptible of such treatment. That is what the physicist, as such, does. He says in effect: Here are a number of categories of experience—*a*, *b*, *c*, *d*, *e;* my business

is to interpret nature in terms of physical mechanism *c*; I, therefore, for the purposes of my special type of interpretation, translate *a* and *b* (let us say colour and sound phenomena) into terms of *c*, in which terms I can treat them mechanically and mathematically. This is surely a quite justifiable methodological procedure. I take it that the physicist, as mere man, never dreams of saying that the colour of a ripe apple or the notes of a woodlark's song are, as modes of experience, less real for the purposes of daily life than the ethereal undulations or the auditory vibrations into which he translates them for the purposes of physical explanation. He hears, like one of us, the Kreutzer Sonata, or sees, in the Dresden gallery, the *Sistine Madonna*. These modes of experience are just as real and valid for him as they are for you and me. But he may urge that these art-products are closely attached to human interests, while, in his laboratory, he studies, in and for themselves, the sound or colour elements out of which these products are compounded. And he may further urge that in his physical investigations he is disclosing realties of a different and more permanent order than those of music and painting.

Such a contention, supposing it to be urged by the physicist, as it is by the exponent of naturalism,

opens up a broad philosophical question as to the nature of experience. John Locke faced the question, and his conclusions are well known. He divided the properties of objects into two groups. Of these the so-called secondary qualities of colour, sound, odour, temperature, and the like depend on the constitution of the human or other being who has experience of them; but the so-called primary qualities, extension and motion, have an independent existence apart from all human or other experience. Of the former he says: "Take away the sensation of them; let not the eye see light or colour, nor the ear hear sounds; let the palate not taste, nor the nose smell; and all colours, tastes, odours, and sounds, as they are such particular ideas, vanish and cease, and are reduced to their causes—*i. e.* bulk, figure, and motion of parts."

But a few years after Locke's death the youthful and brilliant George Berkeley attacked this position, and proved by the most convincing logic that it is untenable. He showed conclusively that it is quite impossible to regard the primary qualities as any more independent of human experience than those which had been termed secondary. Their nature, in so far as known to us, is every whit as much in relation to certain modes and combinations of human

experience. The effect of his now familiar argument was reconstructive as well as destructive. It was reconstructive in that it rehabilitated the categories of colour, sound, odour, and so forth as belonging to the same order of reality, in and for experience, as extension and motion. It was destructive in that it dealt the death-blow to a belief in the independent existence of matter and motion *as such* apart from experience. It knocked the bottom out of materialism as a philosophy. And no amount of soldering and tinkering can make it again hold water.

Let us, however, look a little further into the question at issue between Locke and Berkeley.

IV

AN HISTORICAL CONTROVERSY

MR. BALFOUR, in his *Foundations of Belief*, contends that naturalism is "deeply committed to the distinction between the *primary* and the *secondary* qualities of matter; the former (extension, solidity, and so forth) being supposed to exist as they are perceived, while the latter (such as sound and colour) are due to the action of the primary qualities upon the sentient organism, and apart from the sentient organism have no independent being." If this be so, he says, then, since nine tenths of our immediate experiences of objects are visual, and since "all visual experiences, without exception, are, according to science, erroneous," it follows that, "regarded as sources of information, they are not merely occasionally inaccurate, but habitually mendacious." Whereas perception tells me that the rose-bud is pink and sweet-scented, naturalism, according to Mr. Balfour, denies that it is anything of the sort. The thing itself is not coloured. "As everybody knows, colour is not a property of the thing seen; it is a

sensation produced in us by that thing." The rose-bud shamelessly lies when it pretends to be coloured, whereas it is in reality only trembling with molecular vibrations. Colour and molecular vibrations belong to different orders of reality.

More recently, in his Presidential Address to the British Association at Cambridge (1904), Mr. Balfour asserts that "the aim of the physicist is to ascertain the nature of physical reality—a reality which may or may not be capable of direct perception, a reality which is in any case independent of it, a reality which constitutes the permanent mechanism of that physical universe with which our immediate empirical connection is so slight and so deceptive. That such a reality exists," he adds, "though philosophers have doubted, is the unalterable faith of science."

After briefly and lucidly sketching recent researches which have led up to the view that the physical nature of the atom reveals complex systems of electrical corpuscles, themselves perhaps due to knotted strains in the ether, Mr. Balfour permits himself to indulge in the following reflections:

Now the point to which I desire to direct attention is not to be sought in the great divergence between matter

as thus conceived by the physicist and matter as the ordinary man supposes himself to know it, between matter as it is perceived and matter as it really is, but to the fact that the first of these two quite inconsistent views is wholly based on the second. This is surely something of a paradox. We claim to found all our scientific opinions on experience; and the experience on which we found our theories of the physical universe is our *sense-perception* of that universe. That *is* experience, and in this region of belief there is no other. Yet the conclusions which thus profess to be entirely founded upon experience are to all appearance fundamentally opposed to it; our knowledge of reality is based upon illusion, and the very conceptions we use in describing it to others, or in thinking of it ourselves, are abstracted from anthropomorphic fancies, which science forbids us to believe and nature compels us to employ. The beliefs of all mankind about the material surroundings in which it dwells are not only imperfect but fundamentally wrong. It may seem singular that down to, say, five years ago our race has, without exception, lived and died in a world of illusions; and that its illusions, or those with which we are here alone concerned, have not been about things remote or abstract, things transcendental or divine, but about what men see and handle, about those "plain matters of fact" among which common-sense daily moves with its most confident step and most self-satisfied smile.

Such a position is scarcely satisfactory. One cannot but suspect that there is something not merely paradoxical but radically wrong in a doctrine according to which our common experience is wholly untrustworthy. Berkeley's outlook, much as it has been misunderstood, is saner, and may be so adapted to the existing condition of physical science as to comprise the results of modern physical science. On this view our daily and hourly experience, founded on direct perception, is not illusory, not fundamentally wrong, not mendacious, but eminently reliable and valid *within its appropriate sphere.* It is a guide to practical life, and our only criterion of its trustworthiness is that it enables us to meet all the varied requirements of that life. It affords the data on which, when submitted to physical analysis, may be founded a superstructure of physical conceptions not less reliable within their appropriate sphere. But these are themselves in terms of phenomena, and give us no more information than perception itself of the nature of a reality transcending human perception.

This transcendent reality is, however, just what Mr. Balfour claims as the result of recent physical theory. And he may perhaps secure the suffrages of the unwary when he says that " it is not only inconvenient but confusing to describe as ' phenomena '

things which do not appear, which never have appeared, and which never can appear to beings so poorly provided as ourselves with the apparatus of sense-perception." It must be remembered, however, that the method of science, as I shall endeavour to show, is to carry to its ideal limit the curve of human perception. No one pretends that molecules and atoms, whatever may be their physical structure, can be perceived by man with the sensory endowment with which, for better for worse, he has to rest content. But I take it that the physicist believes them to be *of the phenomenal order*, and that they would be perceived by beings whose senses were indefinitely sharpened and extended in range of application. He endeavours to picture what would be the nature of our experience under these unattainable conditions. That is just why he has throughout his investigations to formulate his conclusions in terms of ideal construction. I seriously question whether any physicist of standing would accept Mr. Balfour's dictum that the conclusions which thus profess to be entirely founded on experience are in any sense fundamentally opposed to it. And I am convinced that the electrical theory of the atom helps in no way to bring us into relation with a different order of reality from that which is common to the whole range of our experience

of natural things and events, and to the refined and extended range of physical science.

Instead of speaking of different orders of reality, we should rather speak of the co-ordinate realities on different planes of the analysis and synthesis of objective experience. Instead of saying that a rose-bud is *not* coloured, *but* capable of reflecting ethereal undulations, we ought to say that it is *both* coloured *and* is a distributor of ether-waves; that these are but two ways of dealing with experience at different planes of interpretation—the one in terms of daily perception, the other in terms of physical science; and that both expressions are dealing with the same order of reality, just in so far as they are dealing with what experience does actually disclose. Recent theories of atomic structure have opened up a new plane of analysis. But to say that these results render our ordinary perceptual experience in any sense illusory or mendacious is unsatisfactory, since it tends to break the solidarity of objective knowledge. Once admit freely and fully the co-ordinate value of all the varied forms of human experience, and the interpretation of nature becomes one closely-related, intelligible whole, to which every possible mode and shade of experience contributes in rendering a connected and rational account of the world in which we live.

But naturalism, according to Mr. Balfour, is deeply committed to the distinction between the primary and the secondary qualities of matter. On the other hand, I said in the last section that Berkeley had conclusively shown that this distinction could not be maintained, since the primary qualities, in so far as known to us, are every whit as much in relation to certain modes and combinations of human experience. Apart from perception and conception, resistance, extension, and the rest have, *as such*, no being of which we can have any cognisance. There is, however, a sense in which it may be said that colour, odour, sound, warmth, and cold belong to different categories of experience from those with which physical science deals in its interpretation of nature. We cannot explain colour phenomena in terms of cold, nor sound phenomena in terms of smell; nor, for the matter of that, can we interpret warmth in terms of resistance or musical timbre in terms of extension. But on a deeper plane of analysis we can render explanations of all the common forms of experience in terms of molar, molecular, atomic, or subatomic motion. Nor can we, indeed, apart from some spiritualistic hypothesis which takes us beyond the range of physical science, conceive of any mode of sensory experience which would not yield on physical analysis

factors belonging to one of these categories. Hence these are *for science* universal in a sense that colour phenomena, sounds, odours, and so forth, are not; and therefore for physical science, just because it is physical science and deals with phenomena on this plane of analysis, all explanations involve translation into terms of appropriate reference. But to admit, nay, contend, that these terms are realities for physical thought is not to allow that any of the modes of human experience are necessarily illusory and mendacious.

It is unquestionably true that the concepts of physical science in terms of atomic and subatomic mechanism involve the process of ideal construction to be presently considered; but this does not remove them into a different order of reality, certainly not into an order of reality independent of human experience. It is just their validity for this experience which brings them within the scope of the only order of objective and physical reality of which we have any cognisance.

That we are incapable of attaining to any knowledge of material existence save as it takes form in relation to perception and conception was part of Berkeley's imperishable contribution to philosophic thought. It is true that the phrascology he em-

ployed rendered him liable to misconstruction. He used the word "idea" not only for all that is represented in mental imagery, but for all that is directly presented through the channels of sensation. The sensory impression of a rose-bud actually seen is, in Berkeley's terminology, an idea. But he never dreamt of denying the reality of common experience, and he would have been the last to admit that it was illusory. "I do not," he said, "argue against the existence of any one thing that we can apprehend, either by sense or reflection. That the things I see with mine eyes and touch with my hands do exist, really exist, I make not the least question." And again, "If by matter you understand that which is seen, felt, tasted, and touched, then I say matter exists; I am as firm a believer in its existence as anyone can be, and herein I agree with the vulgar." And it may be confidently asserted that his arguments leave scientific results within the field of experience absolutely untouched. He was not attacking science or common sense, but an early and crude form of naturalism. One may accept his doctrine of experience without for one moment denying either the reality for practical life of the familiar objects around us or the immense value for science of physical explanation in terms of mechanism; terms in

which they are susceptible of rigid mathematical treatment. Only we must remember that this mechanism is a manifestation to human experience. But a manifestation of what? Unless we are prepared to assert that our experience of the world is self-originating (whatever that may mean), we must postulate an existence which gives rise to the presentations of sense out of which that experience is elaborated. And this existence is independent of us in whom the experience may or may not be generated. Can we know anything of its attributes as thus independent? Notwithstanding all that has been written by philosophers concerning the Absolute, the Unconditioned, and so forth, I question whether unaided thought and reason can ever disclose the positive attributes of this existence, as it is *out of all relation to human experience.* To do so we must somehow get outside our own experience; and that is a feat which we cannot compass. Can we then gain no further insight into the attributes of reality than is afforded by the surface experience of presentations? I venture to think that we can, so far as it is related to us in other ways. At the present stage of my argument, however, I can only put my thought in the form of a question: May not the reality which lies behind the phenomena of this universe be a purpose of which

they are the expression in relation to human purposes? And may not this be a deeper and more spiritual revelation of the nature of existence than the manifestation in terms of mechanism? That manifestation is real with all the reality of sensory experience and scientific thought. But may not the revelation of purpose be equally real though it is in touch with another order of experience? For the present I must be content to leave this in the form of a suggestive question.

V

THE IDEAL CONSTRUCTION OF NATURALISM

THE doctrine that the interpretation of nature is the interpretation of human experience seems to carry with it the implication that it is built upon purely subjective foundations. Thus Herbert Spencer says: "We can think of matter only in terms of mind;" and Huxley contends that physics must confess that "all the phenomena of nature are known to us only as facts of consciousness." So, too, when we pass, as I propose now to pass, to the superstructure of scientific interpretation, George Henry Lewes assures us that "what we call the Laws of Nature are not objective existences, but subjective abstractions—formulæ in which the multitudinous phenomena are stripped of their variety and reduced to unity." In all this there cannot fail to be much that is puzzling to many of us. Hear Huxley again: "Our sensations, our pleasures, our pains, and the relations of these make up the sum total of positive,

unquestionable knowledge. We call a large section of these sensations and their relations matter and motion; the rest we term mind and thinking; and experience shows that there is a constant order of succession between some of the former and some of the latter." Does it not seem somewhat repugnant to common-sense to speak of matter and motion, molecules and electrons, as in reality constituted by "a large section of our sensations and their relations"? Can we feel surprise that Mr. Balfour should urge against such a view that "it involves a complete divorce between the practice of science and its theory. It is all very well," he continues, "to say that the scientific account of mental physiology in general, and of sense-perception in particular, requires us to hold that what is immediately experienced are mental facts, and that our knowledge of physical facts is but mediate and inferential. Such a conclusion is quite out of harmony with its own premises, since the proportions on which, as a matter of historical verity, science is ultimately founded are not propositions about states of mind, but about material things." Scientific men, he says a little further on, "have never suspected that while they supposed themselves to be perceiving independent material objects, their qualities and their behaviour, they were in reality

perceiving quite another set of things, namely feelings and sensations of a particular kind, grouped in particular ways, and succeeding each other in a particular order."

Now when we consider experience from the plainest and most practical standpoint of common-sense, there is disclosed a duality of reference—an objective reference to things and events independent of us severally and individually, and a subjective reference to our own feelings and emotions and to the stream of our individual thought. This duality of reference is an inalienable feature of our experience, but apart from that experience has no meaning. Instead of saying that a large section of our sensations and their relations are termed matter and motion, while the rest are termed mind and thinking, it would be better to say that the *same* group of sensations and their relations which constitute our ordinary perceptions exhibit this duality of reference—objective and subjective. When we look out upon a wide and smiling prospect there is a reference both to what we see and what we feel. Each reference belongs to a different universe of discourse, the one objective and the other subjective; and each is a distinguishable aspect of our common experience. We should, therefore, always be prepared to ask and to answer this

question with regard to any group of experiences: To which universe of discourse do they belong in the treatment I propose to undertake? If we ask this question with respect to the laws of nature we must reply that so far as physical science is concerned they have unquestionably an objective reference, but that so far as mental science is concerned they have subjective reference in that they have their genesis in the psychological processes of abstraction and generalisation. It is with some of the methods of physical science in their objective reference that we have now to deal.

I said that the manifestation which is interpreted in terms of mechanism is real with all the reality of sensory experience. Let us now turn to this interpretation so as to take note of the method of physical science. We may consider first the apparently simple case of a crowbar employed to raise a heavy mass; and no less distinguished a physicist than Lord Kelvin, in association with the late Professor Tait, shall act as our interpreter. He says that even this simple case is too complex for exact treatment, since its accurate mathematical investigation would involve the discussion of a great number of small movements in every part of the bar, of the fulcrum, and of the mass raised. That is impossible; even this simple

case must be simplified. It is a result of observation, however, that the particles retain throughout the process very nearly the same relative positions. Hence the idea of solving, instead of the actual impossible problem, another which is much simpler, but which leads to approximately the same result. Conceive the bar, fulcrum, and mass raised to be perfectly rigid; that is to say, simplify the problem by neglecting all the actual minute changes of position among the particles. Then you can solve the problem; and the solution will very nearly, but not quite, fit the actual facts of the case. You have substituted an imaginary crowbar, absolutely rigid, for the real crowbar which is not absolutely rigid. You have carried, in a scheme of ideal construction, an observed property of crowbars, that they are comparatively unyielding, to its ultimate limits in thought. There you have in a nutshell the method of physics. It deals with simplified ideal constructions, instead of the complicated actual cases; and it carries its mechanical conceptions to their ultimate limits.

This scientific method of dealing with simplified ideal constructions is exemplified in recent researches on the atom.

It has been shown [says Professor Darwin in his

Presidential Address at the South African meeting of the British Association (1905), that the atom, previously supposed to be indivisible, really consists of a large number of component parts. By various lines of experiment it has been proved that the simplest of all atoms, namely that of hydrogen, consists of about 800 separate parts; while the number of parts in the atom of the denser metals must be counted by tens of thousands. These separate parts of the atom have been called corpuscles or electrons, and may be described as particles of negative electricity. . . . The mechanism is as yet obscure whereby the mutual repulsion of the negative corpuscles is restrained from breaking up the atom, but a positive electric charge, or something equivalent thereto, must exist in the atom so as to prevent disruption. . . . It is only just a year ago that Thomson suggested, as representing the atom, a mechanical or electrical model the properties of which could be accurately examined by mathematical methods. . . . Thomson's atom consists of a globe charged with positive electricity, inside which are some thousand or thousands of corpuscles of negative electricity, revolving in regular orbits with great velocities, comparable to that of light, namely 200,000 miles a second. Since two electrical charges repel one another if they are of the same kind, and attract one another if they are of opposite kinds, the corpuscles mutually repel one another, but all are attracted by the globe containing them. The forces called

into play by these electrical interactions are clearly very complicated, and you will not be surprised to learn that Thomson found himself compelled to limit his detailed examination of the model to one containing about seventy corpuscles. It is indeed a triumph of mathematical power to have determined the mechanical conditions of such a miniature planetary system as I have described.

Professor J. J. Thomson's atomic model is thus a simplified ideal construction in which certain electrical conceptions are carried to their ultimate limits. Only thus can the problem of the atom be solved; and the solution representatively fits the case of the more complex atoms of the chemical elements.

Take now the case of the first law of motion. This asserts that if a body be in motion it will continue to move in a straight line and with a uniform velocity unless there are accelerating conditions. But there is no moving particle in this universe that is not in some degree accelerated. We do find, however, that the more we can reduce or eliminate these alien accelerations the nearer do we get to an actual example which shall illustrate the truth of the assertion. But the law itself applies to a state of things under extreme conditions which can be approached but never reached. It is carried to its ultimate limits in a

scheme of ideal construction. Next let us take the case of a planet in motion and at the same time affected by the presence of the sun. Its uniform rectilinear motion is converted into an elliptical orbit. It may here be noted that in the calculations of astronomers the case is further simplified by substituting for the actual bodies material particles or mathematical points to each of which is attached a numerical equivalent representing the mass. Now according to Kepler's second law, the *radius vector*, or straight line joining the mathematical points, always sweeps over equal areas in equal times. That was a grand generalisation, and it is perfectly true of the ideal construction we frame under the supposed conditions. But as a matter of fact in no case is the orbit of any one of the planets in the solar system an ellipse; and in no case does the *radius vector* actually sweep over equal areas in equal times. The other planets cause perturbations, and to determine the actual motion of any one of them is a problem of great complexity. The astronomer has to extend his ideal construction so as to introduce all the important factors. He has to frame a scheme of a number of material particles at different distances from each other, each with its mass coefficient, and then to calculate the movements of any one under the joint influence of all the rest.

Such a material scheme is what is called a configuration. Given the configuration at any selected moment, the motion of any point therein can be calculated. But in the actual solar system there are a number of points the numerical coefficients of which are so small as to be negligible. So that the ideal construction only approximately represents the actual state of the case.

Nevertheless the physical astronomer believes, and asks us to believe, that if we introduce into his ideal construction all the factors, it will hold good of the actual solar system. He claims that he has proved its accuracy so far as observation goes; he urges that wherever we have been able to apply it to the given facts of experience, it fits them to a nicety. Why not go further and believe where we are unable at present to know? I for one am prepared freely and fully to admit the cogency of his appeal. I am a believer within the courts of the temple of astronomical physics. Most of us I think are. But analogous methods may be applied, with far greater difficulty it is true, in other cases where there are different types of configuration—in physiology for example. The configurations here are indefinitely more complex; the influences of the material particles upon each other are much more subtle; it is far less easy, even if

it be possible, to treat the changes within the configuration in terms of mathematical formulæ; an ideal construction in terms of mechanism is at best tentative and hypothetical. Many physicists regard a scientific interpretation of physiological processes in terms of physical mechanism as not yet within the range of practical politics. But thorough-going advocates of naturalistic interpretation have a more robust faith. They are ready to accept, in an attitude of belief, a great deal more than they can definitely prove. What shall be our attitude towards them? Well, I should say: Don't let us attempt to disparage the beliefs which may be all they have to aspire to. And don't let us deny what they may some day, though that day seems somewhat distant, be able to establish. I myself confess to a belief that an interpretation of all the material phenomena of the wide universe in terms of a strictly naturalistic configuration is the ideal which every man of science as such should steadily keep in view, and that his living faith in its ultimate attainment should win our admiration.

That it is an ideal must not be forgotten. And that our most securely established generalisations are reached by carrying in thought to their conceptual limits the legitimate inferences from observations lacking in absolute universality and accuracy should

be fully realised. Take the law of gravitation for example. It is sometimes asked by what right we assume from a limited number of observations—very numerous perhaps but still limited—that the law is universal; and, further, by what right we assume from measurements limited in accuracy—very accurate, no doubt, but still falling short of that which is absolute—that in no particular case is there any variation, even by so much as a hair's-breadth, from the formula which Newton expressed in mathematical terms. The answer is that we carry our law to an ideal limit unattainable by sense and by practical measurement. We assume that it is absolutely and universally true, because in no case has it been shown to be actually and observably false. We sweep our ideal curve through the recorded data of physical measurement, and regard the minute deviations of the actual from the ideal as due to errors of observation. We trust to a reality of thought which we believe to be truer and wider than the realities of sense.

Let us regard a rigidly naturalistic interpretation, then, as an ideal, partially and imperfectly realised to-day, and accepted in an attitude of belief which outruns the assured results of certain knowledge. That amounts to a faith in the universality of the

determinate causal relationship as formulated by science. The first point to notice is that, as thus interpreted, facts and events are just simply and frankly accepted as given in experience. Why they are so given it is not the province of science to discuss. Let us realise quite clearly what this means. It is perhaps most readily grasped in terms of configuration—for example, in astronomy. At any given moment there are a number of material particles in motion at known velocities; to each particle is assigned a numerical coefficient which represents its mass. But the velocities are changing in amount or in direction or both, and such changes of velocities are termed accelerations. Now according to the first law of motion the velocity of any particle, if it could be isolated from the rest, would remain unchanged. There would be no acceleration. The accelerations imply the presence of other particles. Separate from the rest any two, A and B, in thought. The presence of A is the condition of the acceleration of B, and the presence of B of the acceleration of A. The term "force" is applied to the product obtained by multiplying, in this case, the mass of A by the acceleration of which the presence of B is a condition. It formulates in mathematical terms certain conditions within an ideal construction which can thus be

so used as to enable us to predict the changes of velocity which will occur. It does not, for modern physics, assign a reason for these changes; in other words it has no reference to an agency by which the attraction may be produced. Force as a cause of acceleration is not for modern science a physical conception. Now when all the existing velocities and all the force-values within the configuration of any given moment are evaluated, the configuration of the succeeding moment can be predicted. Why the configuration should change in this particular way and not in some other way science does not attempt to explain; it suffices for astronomical physics to say that such is the constitution of nature, or, in other words such is the outcome of experience. The antecedent configuration is termed the cause or condition of that which follows. And this scientific use of the word "cause" should be carefully distinguished from the quite different use of the word by the theologian, who says that God has caused the planets to sweep round the sun in their appointed orbits. The conception of Divine or other agency does not fall within the physical universe of discourse.

If we accept, as a postulate of reason, the existence of some underlying cause, we must be careful to distinguish its agency from the antecedent condi-

tions with which it is the province of science to deal. In the form in which the existence of a First Cause is often naïvely stated and humbly accepted we are bidden to trace a chain of scientific causation, in terms of antecedence and sequence, a long way back in time, and then when we have got as far back as ever we can, we are urged to posit just one more antecedent as the First Cause. But this antecedent is of a different nature from all the rest. They are configurations described in terms of matter and energy. This is no such configuration. Throughout the rest of the chain, wherever scientific explanation rules, any given configuration is not only the cause of the one which succeeds it, but the effect of some other that precedes it. But this is not true of the supposed First Cause.

Instead of an external First Cause, which in the beginning set the spheres a-rolling along their appointed grooves, and stood aside, so to speak, while inorganic evolution ran its course, which then intervened to fashion protoplasm, and again stood aside till this new phase of evolutionary progress reached a certain stage, only to interfere once more, or more than once, to introduce new elements of consciousness and thought—in place of any such occasional influence of causal agency from without, we must rather

accept that wider and more catholic belief in an immanent Power, omnipresent in space and time, of which the sequences of science are manifestations under the conditions of human experience. Nowise restricted to certain specific phenomena on certain specific occasions, its influence is seen here and now in the formation of a snowflake, as it was manifested at some stage in the evolutionary process in the terrestrial origin of protoplasm. But stress must again be laid on the fact that in any such conception the word " cause " is used in a different sense from that according to which it summarises the antecedent conditions with which it is the province of science to deal.

It may be said, however, that, quite apart from any belief in Divine agency, the existence of force as a cause of motion is commonly accepted by physicists. If we ask what is the cause of the attractions which, as a matter of observation, take place within a given sequence of configurations, we shall perhaps be told that it is the force of gravity. And if we require more exact information, it will be said that any two material particles exert upon each other an attractive force proportional to their mass, and varying inversely as the square of the distance between them. Is there, however, an observed antecedent force and

then an observed sequent attraction? Surely not. From the physical point of view it is all one whether we speak of the force of gravitative attraction or the attraction of gravitative force. For physics, at any rate, according to its modern exponents, the attraction and the force are identical, save in so far as the technical term "force" is used to express a mathematical value which can be assigned to the observed strength of the attraction. We may cut out all reference to force in an exact statement of Newton's law without detracting from its scientific value, and say that the *degree* of the gravitative attraction of material particles is directly proportional to their mass and inversely as the square of their distance.

All that we know as to force and motion [wrote W. K. Clifford] is that a certain arrangement of surrounding bodies produces a certain alteration in the motion of a body. It has been usual to say that this arrangement of surrounding bodies produces a certain force, and that it is the action of this force that produces the alteration of the motion. Why have this intermediate term at all? Why should we not go at once from the surrounding circumstances to the alteration of motion which follows? The intermediate term is only a mental inference, either from the existence of the surrounding circumstances or from the occurrence of the alteration

in the motion; and if we only accustom ourselves to pass from one to the other without its assistance it will cease to be necessary, and, like other useless mental conceptions, be gradually forgotten. And with it will pass all tendency to give to this useless mental phantom any such real and material qualities as indestructibility.

Science, therefore, deals exclusively with changes of configuration, and traces the accelerations which are observed to occur, leaving metaphysics to deal with questions concerning the underlying agency, if it exist.

Now in the case of an astronomical configuration we are dealing with accelerations of one order, those which are interpreted in terms of the ideal construction of gravitation. But in the physical universe there are many other orders of acceleration which have to be treated in terms of other formulæ. The atom itself has recently been shown to be a complex configuration with most interesting electrical accelerations. There are configurations which must be dealt with under the laws of cohesion, of chemical affinity, of crystallisation, and so forth. And when we pass from one order of configuration to another, for example from that which is applicable to a solution of common salt undergoing evaporation to that which is applicable to the crystals which are presently formed,

we find that different modes of acceleration emerge for treatment under new ideal constructions. We can indeed often formulate the conditions under which the new modes of acceleration are initiated; but that does not alter the fact that we are passing to different orders of configuration; it does, however, afford grounds for the belief in a natural relationship of any one order to another or others. When water-vapour condenses to the liquid state, and when the liquid freezes, we have in each case a new order of configuration which must be treated under the appropriate rules which experience has shown to be applicable. But they are related, and the conditions of the relationship can be discovered and discussed. New properties emerge; ice has properties which liquid water does not possess; but the conditions of their emergence can be formulated. Why they emerge science does not pretend to say. Such is the constitution of the nature we strive to interpret.

We are thus prepared to understand more fully the developed creed of naturalism. We have seen that, in the scientific interpretation of the motions of the planets, the antecedent configuration is termed the cause or condition of that which follows. Naturalism universalises this conception. It regards the state of the whole universe at any given moment as

a configuration of very great complexity, involving accelerations of many different orders coexisting in natural relationship, and it believes that the cause or condition of this configuration is that of the preceding moment, while the configuration of the succeeding moment is its effect. This involves a splendid act of faith, for it assuredly outruns what can, in the present state of knowledge, be definitely proved. It is the naturalistic creed of evolution. Beginning, so far as naturalism knows anything of beginnings, as a fire-mist or a swarm of meteoric particles, the solar system, with our earth as its most interesting constituent and man as its highest product, has reached its present condition. Again and again have new properties, new modes of accleration, new types of interaction emerged, as minor configurations have been successively differentiated; but every such emergence has been rigidly conditioned and determined within the major configuration embracing the universe at large. In those cases where the conditions of emergence are as yet unknown, as, conspicuously, in the origin from not-living matter of the physical basis of life, with its characteristic properties and its puzzling physiological accelerations, we are bidden to believe, though we cannot establish by observation. This is part of the evolu-

tionary creed for the earnest and consistent believer. I confess that as an evolutionist I am myself both ready and willing to believe; but I shall presently claim the right to exercise a like option in other fields of human thought, and in an interpretation of a different order. For the naturalistic creed deals only with the conditions of evolution. The conception of a causal agency of which evolution is the expression, if such indeed there be, is excluded from a naturalistic interpretation of nature so far as it is based on the methods of physical science.

VI

THE WEB OF CAUSATION

WE live in a world in which effect follows cause in an orderly and, we are apt to suppose, invariable rhythm. According to modern modes of thought, it matters not where we tap the fount of scientific inspiration, we always find that the untiring search for the antecedents of any event is founded on the conviction that for that event there is some ascertainable cause. Even chance has yielded to the statistical method, so that its laws may be formulated. By dealing with larger and larger numbers we eliminate more and more the idiosyncrasies of the particular case. And thus we come to realise that what we call chance in the tossing of a coin is only our ignorance of the nature and immediate cause of these idiosyncrasies. Just in so far as our science or its application is imperfect, do we project upon the screen of nature, woven by our experience, the shadow of fortuity, blurring the details of processes which, to less imperfect mental vision, would stand out clearly as causally related. Thus it arises that, for

those who have been led to this point of view, the doctrine of evolution, as applicable throughout the range of an experience which science indefinitely prolongs, gives expression to the daily strengthening belief that the state of matters at any given moment is the outcome of a state of matters in the preceding moment, and in like manner serves to determine the state of matters in the moment that follows.

As to the origin of our belief in the universality of causation there has been much discussion, one school of thought contending that it is the outcome of experience, another school of thought urging that it is prior to and a condition of all scientific interpretation. "It is commonly urged," said Huxley, "that the axiom of causation cannot be derived from experience, because experience only proves that many things have causes, whereas the axiom declares that all things have causes. The syllogism, 'Many things which come into existence have causes, A has come into existence, therefore A had a cause'—is obviously fallacious, if A is not previously shown to be one of the 'many things.' And this objection is perfectly sound so far as it goes. The axiom of causation cannot possibly be deduced from any general proposition which simply embodies experience. But it does not follow that the belief, or expectation,

expressed by the axiom is not a product of experience generated antecedently to, and altogether independently of, the logically unjustifiable language in which it is expressed. In fact," he continues, "the axiom of causation resembles all other beliefs of expectation in being the verbal symbol of a purely automatic act of the mind, which is altogether extra-logical, and would be illogical, if it were not constantly verified by experience." In other words, in this as in other matters where the schematic constructions of science are concerned, we sweep a curve of interpretation through a series of observed phenomena and carry it on beyond the confines of observation to its ideal limits.

Yet further discussion has arisen as to the nature of the links which join cause to effect. And as this will serve to emphasise the distinction between scientific and metaphysical causation, we may look into the question a little further.

Glanvill, in his *Scepsis Scientifica*, published in 1665, says: "All knowledge of causes is deductive; for we know of none by simple intuition, but through the mediation of their effects. So that we cannot conclude anything to be the cause of another but from its continual accompanying it, for the causality itself is insensible." Let us specially note these

words—"for the causality itself is insensible." "What we call experience," said Hobbes a few years before, "is nothing else but remembrance of what antecedents have been followed by what consequents." Such statements as these may have been the seeds which germinated in the mind of Hume and developed into his well-known theory of causation. In any case it is evident that he thought the matter out for himself with his customary vigour and independence. We may profitably make his treatment of the subject our starting-point.

"When we look about us towards external objects, and consider the operation of causes," said Hume in that section of the *Enquiry* which treats of the Idea of Necessary Connection, "we are never able in a single instance to discover any power or necessary connection, any quality, which binds the effect to the cause, and renders the one an infallible consequence of the other. We only find that the one does actually in fact follow the other. The impulse of one billiard ball is attended with motion in the second. This is the whole that appears to the outward senses. The mind feels no sentiment or inward impression from this succession of objects. Consequently there is not, in any single, particular instance of cause and effect, anything which

can suggest the idea of power or necessary connection."

For a comprehension of Hume's conception stress must be laid, in this passage, on the words "in a single instance." When he says that we are never able *in a single instance* to discover any power or necessary connection, these four words are not merely inserted to emphasise the *never;* they are to be taken literally. We are never able, from the study of a single and isolated case or example, to discover any power or necessary connection. According to Hume:

> This idea of a necessary connection amongst events arises from a number of similar instances, which occur, of the constant conjunction of these events; nor can that idea ever be suggested by any one of these instances, surveyed in all possible lights and positions. But there is nothing in a number of instances, different from every single instance, which is supposed to be exactly similar; except only, that after a repetition of similar instances the mind is carried by habit, upon the appearance of the one event, to expect its usual attendant, and to believe that it will exist. This connection, therefore, which we *feel* in the mind, or customary transition of the imagination from one object to its usual attendant, is the sentiment or impression from which we form the idea of power or necessary connection. . . . The

first time a man saw communication of motion by impulse, as by the shock of two billiard balls, he could not pronounce that the one event was *connected;* but only that it was *conjoined* with the other. After he has observed several instances of this nature, he then pronounces them to be *connected.* What alteration has happened to give rise to this new idea of *connection?* Nothing but that he now feels these events to be connected in his imagination, and can readily foretell the existence of the one from the appearance of the other. . . . When many uniform instances appear, and the same object is always followed by the same event, we then begin to entertain the notion of cause or connection.

The first question we may ask concerning the views which are thus so clearly and forcibly expressed is this: Does Hume disclose anything beyond observable or frequently observed succession? Obviously not. Let us take a matter of common experience. The flash and the report of a distant cannon are so habitually connected in experience that the occurrence of the one suggests the other through association. Here we are simply describing certain facts of experience in terms of antecedence and sequence. Of any "power" or "strongest necessity" Hume should be, and I take it actually was, the last to see in mere custom the smallest indication. To modify the words of Hobbes without altering his meaning we may say,

"What we call custom is nothing else but remembering what antecedents have been followed by what consequents"; and we may add in the phrase of Glanvill, "For the causality itself is insensible."

Hume's primary contention may be thus summarised: All that is disclosed to experience may be expressed in terms of actually observed or observable antecedence and sequence. "The scenes of the universe are continually shifting, and one object follows another in uninterrupted succession; but the power or force which actuates the whole machine is entirely concealed from us, and never discovers itself in any of the sensible qualities of body. When Herbert Spencer said that "by the Persistence of Force we really mean the persistence of some Cause which transcends our knowledge and conception" he was using the terms "force" and "cause" for the "power which actuates the whole machine"—was using them, therefore, in a non-scientific or metaphysical sense.

For science occupies Hume's position with some amendment and extension. He dealt largely with the naïve expectations of daily life. And his doctrine of the effects of custom and habit led him, no doubt, as Reid pointed out, to exaggerate the importance of the repetition of experience. When the conception

of uniformity, as part of the ideal construction of science, has been reached, a single accurate and precise determination of the essential antecedent conditions of any event is sufficient. Hobbes, in a passage which is quoted by Jevons, had already brought out another important feature when he said, "A cause is the sum or aggregate of all such accidents, both in the agents and the patients, as concur in the producing of the effect propounded; all which existing together, it cannot be understood but that the effect existed with them; or that it can possibly exist if any one of them be absent." Mill accepted and endorsed this view. "The real cause," he said, "is the whole of the antecedents; and we have, philosophically speaking, no right to give the name of cause to any one of them exclusively of the others." True and important, "philosophically speaking," as is this identification of the cause with the totality of the antecedent conditions, it is none the less true that "scientifically speaking" it is the aim of physics to isolate the factors of phenomena and to disentangle the threads which are woven into the totality of antecedent conditions. It is this disentanglement which serves, in part at least, to distinguish the ideal scheme of physics from the complex web of natural phenomena, which with ever-increasing success it en-

ables us to interpret. At the same time it should be noted that this method of scientific procedure does not at all invalidate Hobbes's contention. For though physics adopts the method of anaysis with a view to isolating the factors of causation, it still remains true that, when its results are applied to a complex phenomenon such as Hobbes had in view, no interpretation can be satisfactory unless all the co-operating antecedents are represented synthetically in due quantitative proportion. Accepting, therefore, the validity of Hobbes's contention that the cause is the totality of the conditions, we may add, as a rider, that science analyses this complexion into its factors and utilises the results of its analysis in synthetic interpretation.

Such, I take it, is the conception of physical causation we reach when we reduce the notion of sequence to its ideal limits. It is the doctrine of Hume translated from the region of practical observation into the region of conceptual thought founded thereon. And in this sense we may say that modern science accepts the doctrine in its essential features. Why the sequence is of that nature which we find it to be in the data of sensory experience, physical science as such, does not, I conceive, attempt to explain. Here are the facts as practically given;

that is an end of the matter so far as physical science is concerned.

It may, however, be said that I am attempting to impose on physical science restrictions which the physicist himself will not be ready to accept. Permit me therefore to quote a paragraph from Professor Lamb's Presidential Address before Section A at the Cambridge (1904) meeting of the British Association. It will serve to lead up to the next step in my argument.

We have, most of us [he says] frankly adopted the empirical attitude in physical science; it has justified itself abundantly in the past, and has more and more forced itself upon us. We have given up the notion of causation, except as a convenient phrase; what were once called laws of nature are now simply rules by which we can tell more or less accurately what will be the consquences of a given state of things. We cannot help asking, however: How is it that such rules are possible? A rule is invented in the first instance to sum up in a compact form a number of past experiencs; but we apply it with little hesitation, and generally with success, to the prediction of new and sometimes strange ones. Thus the law of gravitation indicates the existence of Neptune; and Fresnel's wave surface gives us the quite unsuspected phenomena of double refraction. Why does nature make a point of honouring our cheques

in this manner, or, to put the matter in a more dignified form, how comes it that, in the words of Schiller—

"Mit dem Genius steht die Natur im ewigen Bunde
Was der eine verspricht leistet die andre gewiss."

The question is as old as science, and modern tendencies have only added point to it. It is plain that physical science has no answer; its policy, indeed, has been to retreat from a territory which it could not securely occupy. We are told in some quarters that it is vain to look for an answer anywhere. But the mind of man is not wholly given over to physical science and will not be content for ever to leave the question alone. It will persist in its obstinate questionings, and however hopeless the attempt to unravel the mystery may be deemed, physical science, powerless to assist, has no right to condemn it.

Let us now see how we stand. Naturalism, interpreting the material universe in terms of mechanism, formulates an ideal construction in terms of causal antecedence and sequence; in this it believes with a faith which is worthy of our admiration, since it is founded on certain selected aspects of experience. When it is modest, which I fear is not always the case, it confesses that its ideal construction cannot as yet always be applied with confidence to the observed facts, but it claims that wherever and whenever,

in the existing state of assured knowledge, it can be so applied it fits the actual facts (new facts as well as old) with much accuracy. Let us accept this position and see what follows. The ideal construction of naturalism is admittedly rational and connected. But when this scheme (which is the product of our rational thought) is applied to the data of sensory experience (which are independent of our rational thought and over which our reason has no control) it is found to fit the given changes of configuration. Hence, just in so far as the connections of the ideal scheme coincide with the sequences of sensory experience, may we assume that these sequences have some underlying connection—something which makes them of such a kind that they can be rationally treated. Science, however, ignores, though it should not deny, the existence of a " power or force which actuates the whole machine " ; it does not attempt to discuss the question why the antecedences and sequences which it studies are of such a kind as we find them to be. Some of us, nevertheless, as Professor Lamb indicates, are impelled by the very nature of our rational thought to seek an answer to this question. We, too, have our ideal constructions. We, too, have our beliefs which perchance include more than we can definitely prove. I for one believe

that the connected and rational character of our ideal schemes of naturalism have their source and origin in the rational and connected character of the reality which underlies objective existence. But the reality beneath our systems of thought is the unity of human purpose which gives to every item significance within the connected scheme. Again, therefore, I am led to ask: May not the reality which is manifested in objective existence—that nature which we strive to interpret—be the unity of purpose which underlies it too, and gives to the world of phenomena a significance which would otherwise be wholly wanting?

It is commonly urged that in the phenomena observed in living creatures there is a special manifestation of purpose differing from that of which physical science yields far less convincing evidence. To a consideration of some of these phenomena we may now turn.

VII

THE PROBLEM OF LIFE

FROM whatever point of view we regard the problem of life we are in the presence of a group of of related phenomena which are peculiar to and characteristic of protoplasm. In the simplest living organism the organic characters enact a drama nowhere played in just this way on any inorganic stage. There is a continuous give-and-take both of matter and energy which is scarcely so much as hinted elsewhere; there is a unified sequence of changes constituting a continuous life-history, which may reach great complexity, and affording the basis of our conception of development; and there is through the process of reproduction an extended continuity which is now interpreted in terms of evolution. Is it a matter for wonder that the origin and significance of these vital phenomena, seen alike in a microscopic speck of amœboid protoplasm, and in the quickened body of man, with its multitude of closely-related living cells, have long been regarded

as fraught with "a mystery transcending naturalistic conception, as an alien influx into nature baffling scientific interpretation?"

The problem before the biologist, who seeks to contribute within his special domain to the interpretation of nature, is this: Given life and its environment, to describe in particular cases the sequence of events presented by individual development and racial evolution, and by generalising the results so reached to afford a scientific explanation of the phenomena. This is a difficult problem, and one well worthy of the intellect of Darwin and his followers. The results so far obtained call forth our sincere admiration, and augur well for yet further advances in biological knowledge. Accepting, as facts based upon observation, first that variations occur among offspring, secondly that more young are born than can or do survive to propagate their kind and transmit their peculiar idiosyncrasies, and thirdly that there is a struggle for existence leading to the elimination of the variants less fitted to their place in a complex scheme, Darwin was led to the conclusion that the survivors were those best adapted to their environment, and that herein lay the conditions of progress and of varied adaptation such as is seen in the multifarious species of the organic world.

Whether natural selection is all-sufficing as a principle of interpretation, or whether it must be supplemented by other factors, are questions which are keenly discussed; but that all the factors are of the scientific order and susceptible of interpretation in a scheme of naturally-conditioned sequence is the contention of naturalism. Darwin accepted the existence of variations on the ground of observation; the conditions of their occurrence and origin have occupied the attention of his successors. Their nature and distribution have been discussed by the application of more and more refined statistical methods. Weismann and Mendel have suggested hypotheses based upon the intimate structure and properties of the germinal substance and the properties of its constituent units. Much still remains to be done. But the naturalistic conviction gains daily in strength and cogency that the totality of life and its conditions to-day is the outcome of the life and its conditions of yesterday, and will surely give rise to the life and its conditions of to-morrow. This is the creed of evolution. The ideal towards which biological science is slowly but surely advancing is the description of the assemblage of antecedents which constitute the cause and the assemblage of consequents which we name the effect, and the complete

formulation of the relations of the one assemblage to the other. But, it is urged, when the riddle of development and of evolution shall have been answered in terms of the ideal constructions of biological science, the riddle of life will still remain unsolved and insoluble in these terms.

What is life? As used by the man of science the term comprises an observable sequence of phenomena. We can from his standpoint neither say that life is due to the phenomena nor that the phenomena are due to life. The sequence itself, as it actually occurs, is just that which characterises what the biologist terms life. And though he may speak of the phenomena as those characteristic *of* life, all that is meant by this expression is that this or that particular phenomenon falls within the group to which the term "vital" is properly applicable. If, then, by life we mean the underlying cause of the sequence itself, then the question, What is life? is one with which the biologist, *as such*, has no concern. Life in this sense in biology, like force in an analogous sense in physics, is altogether outside the scientific universe of discourse. Whether it is or is not, or if it be, in what sense it is "an alien influx into nature," are questions which must be tried before a different court of appeal.

It is true, and should be frankly admitted, that in the present state of natural knowledge the antecedent conditions of the genesis of protoplasms are unknown. Some of the products of protoplasm, the so-called organic compounds, can be manufactured in the laboratory. In the case of the more complex products the difficulty is to discover the long sequence of progressive stages which lead up to the final synthesis. And we may well suppose that the complete sequence of all the appropriate stages of the synthesis of living protoplasm is of the rarest occurrence, may even have occurred only at a certain stage of the earth's history. That it has occurred is part of the faith of the evolutionist; it is accepted as a corollary from the ideal construction of naturalism taken as a whole. And granting, as we should grant with befitting frankness, that the antecedent conditions of its genesis are unknown, what then? With so much that is, and is likely long to remain, unknown to science it surely ill beseems us to build too much upon this. It is but our familiarity with the genesis of the crystal that affords any justification for the supposition that this is the outcome of a natural evolution while the genesis of protoplasm is not so. Science can tell us in this case no more than in that of protoplasm the *why* of its existence; while

even of the *how* of crystalline architecture science can only say that, given such and such conditions, it appears. Of protoplasm we may likewise say that under certain conditions, at present unknown, it appeared. Those who would concentrate the mystery of existence on the pin-point of the genesis of protoplasm do violence alike to philosophy and to religion. Those who would single out from among the multitudinous differentiations of an evolving universe this alone for special interposition would seem to do little honour to the Divinity they profess to serve. Theodore Parker gave expression to a broader and more reverent theology when he said: "The universe, broad and deep and high, is a handful of dust which God enchants. He is the mysterious magic which possesses"—not protoplasm merely, but—"the world."

It may be asked, however, Why is a sense of mystery especially evoked in some minds by the contemplation of life? Partly, I think, because the scientific interpretation of organic processes is so recent, and in many respects so incomplete. People have grown so accustomed to the metaphysical assumptions employed by physicists and chemists when they speak of the architecture of crystalline forces and the selective affinity of atoms, they have been wont for so long to accept the "mysteries" of crystallisation

and of chemical union, that the metaphysical causes have coalesced with the descriptions and explanations of science, and the joint products are now, through custom, cheerfully accepted as "natural." Where the phenomena presented by protoplasm are in question, this coalescence has not yet taken place; the metaphysical element is on the one hand proclaimed as inexplicable on naturalistic methods of interpretation, and on the other hand denied even by those who talk glibly of physical forces. But in due course of time this, too, will be commonly accepted as perfectly natural, and the battle will rage elsewhere.

Our attitude towards the vexed question of Vitalism, or the existence of a specific Vital Force, must depend on whether we regard the question from a strictly scientific or from a metaphysical standpoint. It is unnecessary to enter at any length into the past history of the subject. Sufficient unto the generation are the conditions under which its problems must be discussed. Of old, before the forces of science had girt their strength about them, Vitalism held the field in easy if somewhat lax possession. Then came a period of organised attack. Chemistry and molecular physics had formulated and extended their generalisations and began to urge that the problems of physiology were problems of chemistry and phy-

sics—nothing more. There was no vital remainder. Taking their stand on the conservation of energy, they contended that the conception of Vital Force involved the unproven and improbable appearance of energy without physical or chemical antecedents. This carried conviction among some of our leading physiologists. Professor (Sir John) Burdon Sanderson wrote: "The proof of the non-existence of a special 'vital force' lies in the demonstration of the adequacy of the known sources of energy in the organism to account for the actual day by day expenditure of heat and work." But an answer in due course came from the Vitalists. It was pointed out that the application of a force to a moving body at right angles to its course alters the direction of motion without affecting its amount. The energy remains unchanged. Of such a directive character, it is sometimes urged, may be the application of Vital Force without presenting any phenomena contradictory of the generalisation that, in the operations of nature, energy is nowhere either destroyed or created.

So long as the metaphysical conceptions of Force are carelessly commingled with the generalisations of dynamics as a science, this line of argument may appear to possess a cogency which is in truth fictiti-

termed the basal law of dynamics cannot. There are movements of material particles which are outside this generalisation. It is questionable, however, whether there are many Vitalists of scientific training who would care to contend for the truth of this conclusion.

In an able address delivered at the meeting of the British Association in 1898, the President of the Chemical Section, Professor Japp, urged that life products have certain optical properties which imply a selective agency of a kind otherwise unknown—of a kind which cannot reasonably be attributed to the interaction of forces familiar to the student of chemistry and physics. The phenomena are those known as rotary polarisation. The plane of a beam of polarised light is twisted to left or to right on passing through certain crystalline substances and certain solutions. A solution of racemic acid is inactive or has no effect of this kind. But if it be allowed to crystallise rhombic hemihedral crystals are formed. These are asymmetrical, but some are asymmetrical in one direction, some in another, so that the crystals of one group are like mirror-images of those of the other group. Such crystals are termed enantiomorphs. Now if a number of the crystals of one group are picked out and dissolved, and a number of

the crystals of the other group are similarly selected and dissolved, the two solutions thus obtained exhibit rotary polarisation. In the one case the plane is twisted to the right, and in the other case in like degree to the left.

But if, instead of crystallising the original solution, a vegetable "mould," *Penicillium*, be grown in the solution, and the solution be then filtered, it will be found to exhibit left-handed rotary polarisation. The mould has selected the right-handed moiety of the racemic acid for the purposes of its growth, and a left-handed residuum remains. And this is the outcome of the vital forces of the mould. "I see no escape," says Professor Japp, "from the conclusion that when first life arose, a directive force came into play—a force of precisely the same character as that which enables the intelligent operator, by the exercise of will, to select one crystallised enantiomorph and to reject its asymmetric opposite." "No fortuitous concourse of atoms, with all eternity to clash and combine in, could compass the feat of the formation of the first optically active organic compound."

Interesting and important as are these phenomena, they do but disclose one of the many properties characteristic of living matter. The existence of these properties the man of science accepts on the basis of

observation, but he believes that their emergence is related to antecedent conditions of the natural order which are ideally explicable in terms of the sequence of configurations of which evolution is the scientific expression. Naturalism admits that when life first appeared new modes of the interaction of material particles occurred; new data were afforded for science to deal with in accordance with its canons of interpretation, but naturalism does not admit that this necessarily implies an "alien influx into nature." According to the creed of naturalism there is nothing alien introduced into nature from without, all the influences at work are inherent in the flow of her being; and of these under influences all that we know is that under appropriate conditions certain observable sequences do actually occur. Agnosticism denies that we can draw any inference from the nature of the sequence to a purpose of which it is the expression.

That is one side of the shield. Professor Lapp was looking at the other side when he said that when first life arose a directive force came into play—a force of precisely the same character as that which enables the intelligent operator, by the exercise of will, to select one crystalloid multimorph and to reject its asymmetric opposite. Such a directive

to emphasise the rationality of purpose, as does also the growth of our knowledge which naturalism is bound to interpret in terms of antecedence and sequence; for after all it is the rational nature of the whole of our experience which for those who can accept the doctrine of purpose testifies throughout to its rational character. As Mr. Balfour says in his British Association address:

Extend the boundaries of knowledge as you may; draw how you will the picture of the universe; reduce its infinite variety to the modes of a single space-filling ether; retrace its history to the birth of existing atoms; show how under the pressure of gravitation they became concentrated into nebulæ, into suns, and all the host of heaven; how, at least in one small planet, they combined to form organic compounds; how organic compounds became living things; how living things, developing along many different lines, gave birth at last to one superior race; how from this race arose, after many ages, a learned handful, who looked round on the world which thus blindly brought them into being, and judged it, and knew it for what it was—perform, I say, all this, and, though you may indeed have attained to science, in nowise will you have attained to a self-sufficing system of beliefs. One thing at least will remain, of which this long-drawn sequence of causes and effects gives no

satisfying explanation; and that is knowledge itself. Natural science must ever regard knowledge as the product of irrational conditions, for in the last resort it knows no others. It must always regard knowledge as rational, or else science itself disappears.

The consideration of the growth of our knowledge, however, brings us into touch with mental science. Let us see what naturalism has to say concerning an interpretation of mental phenomena.

VIII

MIND AND MECHANISM

THE hypothesis of mental development in the individual and mental evolution in the race is now generally accepted; widely accepted, too, in the close and intimate connection of brain nd mind. We have to consider, then, some of the implications of a strictly naturalistic interpretation of consciousness as a function of nerve tissue. I shall deal with the matter as far as possible from the strictly scientific standpoint, leaving metaphysical inferences entirely on one side for the present.

A number of facts which are sufficiently familiar, and which are generally admitted, warrant us in believing that, in many cases, mental states are, in some way that we cannot adequately explain, the concomitants of certain organic changes in the brain. It cannot be proved that this is so in all cases. But the method of science is, as we have seen, to carry its generalisations to their ideal limits—limits which go beyond the boundaries of actual observation. In

a word, science believes, and is methodologically justified in believing, more than it can definitely prove. Applying, therefore, this principle of extension, it is assumed that mental states are, not only in a great number of instances, but always and whenever they occur, the concomitants of changes in nerve-centres. Every psychical state has its physiological counterpart in the brain or analogous organ. But we are certainly not in a position to make this a convertible proposition. We cannot say empirically that every physiological change in the brain or analogous organ has its concomitant state of consciousness. All that we seem justified in assuming on naturalistic assumptions is that *some* nerve-changes are accompanied by consciousness, and that *all* states of consciousness have for their physiological counterparts nerve-changes.

If, then, we accept the doctrine of mental evolution, we must accept it as a rider to biological evolution. A very large and well-attested body of evidence has been accumulated by biologists, from which we may safely infer that there is continuity in the development of the nervous system from the fertilised ovum, and that there is continuity in the evolution of the germinal substance. The fertilised ovum is the connecting link between parents and offspring. If, then,

there be a continuous evolution of the nerve-centres, some part of the functional activity of which in some way involves mental concomitants, we may interpret mental heredity in terms of organic continuity. And in no other terms can we interpret it empirically. Furthermore, some progress has been made in correlating behaviour as an index of mental endowment with the development of the nerve-centres, and the results of such correlation seem to lend support to the view that nerve-evolution and mind-evolution run a parallel course.

Does such a view necessarily involve the acceptance of Huxley's doctrine of animal and human automatism? His central positions are: first, that organically or biologically the total sequence of events in the nervous system of men and animals is a physiologically determinate sequence; and, secondly, that consciousness is an epiphenomenon, all conscious guidance and control being an illusion which is the outcome of the vain imaginings of a popular superstition baseless and without foundation.

With regard to the first position, Huxley was on safe naturalistic ground *within, and only within, the ideal construction of physiological science.* I do not see how physiology, as a departmental science, can possibly prosecute its researches on any other

assumption. And if Huxley had contented himself with urging that all the actions of men and animals are, for biology, physiologically determinate, without saying anything about collateral products in consciousness, I should accept his position as that necessarily incidental to the limited and restricted survey of physiology.

But I am unable to accept the view that consciousness is a by-product of the functional activity of the nervous system; that what we call intelligent choice and volitional decision count for nothing; that they are merely the conscious symbols which accompany certain brain-changes. On this view the same acts which we vainly imagine to be the outcome of conscious motives would be performed in precisely the same way if those by-products of physiology were absent. An unconscious Shakespeare would have written *Hamlet* to stimulate the nervous mechanism of an unconscious audience. So long as Huxley held to the contention that every conscious state has as its concomitant a molecular change in the brain, he gave expression to a naturalistic assumption which is necessary for physiological interpretation; but when he said that consciousness is merely the steam-whistle of life's locomotive, or merely answers to the sound which the animal bell gives out when it is

struck, he takes up a position of far less strategical strength. I hold it to be an utterly unjustifiable assumption to say that the consciousness which is admittedly present has practically no effect whatever on the behaviour, and I am unable to understand how any evolutionist who accepts this conclusion can explain on evolutionary grounds the existence of a useless adjunct to neural processes.

"It is," says Huxley, "experimentally demonstrable—any one who cares to run a pin into himself may perform a sufficient demonstration of the fact—that a mode of motion of the nervous system is the immediate antecedent of a state of consciousness." I would here interpolate the question whether any *antecedence* is either proved or provable, but let that pass. "We have," continues Huxley, "as much reason for regarding the mode of motion as the cause of the state of consciousness, as we have for regarding any event as the cause of another. How the one phenomenon causes the other we know as much, or as little, as in any other case of causation, but we have as much right to believe that sensation is the effect of the molecular change, as we have to believe that motion is an effect of impact; and there is as much propriety in saying that the brain evolves sensation, as there is in saying that an iron rod when

hammered evolves heat." I venture to question the validity of this analogy, for heat is a mode of energy, and only emerges through the transformation of other and pre-existing modes of energy. A certain amount of the energy of motion in the massive hammer-head is transferred to the iron rod, and assumes the form of that molecular motion which we call heat; and by what amount the one is the gainer, by that amount is the other the loser. But we have no reason to suppose that the like takes place in the origin of mental concomitants of neural changes. No part of the brain's store of physical energy is drained off to form the rivulet of consciousness. But again let this criticism pass. Granting that a mode of motion in the nervous system is the immediate antecedent of a state of consciousness, granted that the pin-prick is a proof of the fact, granted that we may speak of the related antecedent as a cause, it is not obvious why we should not describe the desire of demonstrating the supposed fact as the cause of running in the pin. We seem to have just as much reason for calling this antecedent state of consciousness the cause of certain movements and behaviour, as for calling a mode of motion in the brain the cause of a further state of consciousness. It is true that we have not the least idea how the desire can cause

the act; but Huxley practically admits that we have no idea how molecular change can be the cause of consciousness. In the one case we are no worse off than we are in the other.

The difficulty of conceiving how mind can act on matter and matter can act on mind seems to be empirically insuperable. The physiological series and the psychological series are incommensurate. Empirically we must confess our complete ignorance of the nature of the ultimate relation of the one to the other. But, none the less, in many cases observed facts show that they *are* in some way related. Empirically, therefore, our only course seems to be to leave on one side the ultimate relation of the one to the other, and deal with the concomitance as an unexplained fact of observation; or, if an assumption must be made, the safest assumption is that what from a physical and physiological point of view is a complex molecular disturbance is at the same time from a psychological point of view a state of consciousness. The two are different aspects of one natural occurrence. Why such an occurrence should have two so different aspects we have not the faintest idea; but here we are not one whit worse off than we were before. It does, however, enable the physiologist and the psychologist to deal independently, each

with that group of facts which may be requisite for his ideal construction. What does this imply? It certainly does not imply that either series would remain just what it is if the other series were non-existent. As well might two Irishmen assert that because each saw but one side of their boundary wall the other side did not "count for anything at all, at all." A Scotchman would point out that each side counted, but that you could not see both at once. The inevitable incommensurability of the physiological and the mental series implies that we can only pass from one to the other in the same argument by changing the point of view. But if the state of consciousness actually is the very same something which the physiologist calls, in the language of physics, a molecular disturbance, we may change the point of view as often as we like with perfect freedom. In fact we do so, in effect, every day of our lives whenever we say that certain occurrences in the external world give rise to a train of thought as the outcome of which we act in this or that particular manner. If, however, we adopt this course, and if we allow ourselves to say that the occurrences cause, or are the antecedents of, the train of thought, we have every bit as much right to affirm on precisely the same grounds that the train of thought causes the acts

which follow. In saying that consciousness influences behaviour one who accepts the double-aspect theory of concomitance is merely avoiding a cumbrous form of circumlocution. He puts it in this way instead of saying that the nerve-changes in the cerebral cortex, which from a psychological point of view *are* a conscious situation or a train of thought, influence and determine the course of behaviour. But from this point of view it is absurd to say that consciousness is merely an adjunct, a by-product, an epiphenomenon—absurd to say that were there no conscious situation the neural situation would remain unchanged. They are the very same thing regarded from different points of view; and to say that there is no influential conscious guidance and control is simply equivalent to saying that there is not the determining condition of the cerebral cortex, which is its organic concomitant. For, as I said before, on the assumption of concomitance, "cerebral control system" and "mind" are interchangeable terms.

As a matter of fact, in large sections of human life and conduct we know a great deal more about the mental aspect, with its antecedences and sequences, with its doctrine of values for consciousness, than we do about its physiological aspect. When a man receives a letter offering him an appointment under

certain conditions, we can at least in some degree interpret in psychological terms what intervenes between the receipt of the offer and the despatch of a reply. We can only in the vaguest and most general terms interpret what goes on in his cerebral hemispheres. If we admit that there are cortical concomitants, we must also admit that we know very little about them. That is why we are forced to change our point of view in the midst of an interpretation of what naturalism—physical and psychological—regards as a strictly determinate series. But to say that these conscious deliberations are merely a by-product of the physiological processes, of which we know so little; to say that they are only collateral effects of brain mechanics; is tantamount to saying, as Professor Herbert put it, "that the actions, words, and gestures of every individual of the human race would have been exactly what they have been in the absence of mind; had mind been wanting, the same empires would have risen and fallen, the same battles would have been fought and won, the same literature, the same masterpieces of painting and music would have been produced, the same religious rites would have been performed, and the same indications of friendship and affection given." That is what the steam-whistle theory of

consciousness involves, and that is a view which, I venture to think, cannot possibly be accepted.

In place of this we have, still however on the naturalistic interpretation, a continuous biological series of events completely explicable in terms of antecedence and sequence; and a discontinuous mental series, sections of which may be explained in terms of subjective or ejective sequence, while intervening sections have to be explained by referring us to organic conditions. By the doctrine of concomitance the ideal construction of psychology is brought into relation with the ideal construction of physiology. But according to naturalism the ideal construction of physiology may itself be brought into relation with the ideal construction of physics, and the phenomena may be interpreted in terms of physical configurations. Hence, in naturalistic analysis and synthesis concomitance links together physical configurations, and what we may term psychological configurations or dispositions. But there is no necessary reference to any underlying cause through the agency of which the configurations or dispositions change in this way or in that.

IX

THE SCIENCE OF METAPHYSICS OF WILL

A COMPLETE and satisfactory interpretation of nature, is so far as it is attainable by man, partly scientific and partly metaphysical. It has been my object to distinguish these factors. The departmental studies such as physics and biology are founded on our perceptions in their objective aspect, having a correspondence of reference for independent observers, and afford explanations in terms of antecedence and sequence in a doctrine of scientific causation. They deal with the observed moves among the pieces on the checkered chess-board of experience, leaving to metaphysics the question how there comes to be a game to be played, and when this is settled how, or by what unseen agency, castles and knights and pawns are moved, each with a distinctive path across the board.

But the perceptions and all the varied data of presentational experience not only *have* an objective reference with which such sciences as astronomy, geo-

logy, biology, and the more analytical studies of physics and chemistry are concerned, they *are* also states of consciousness. And these states of consciousness follow each other in orderly, or at any rate for science determinate sequence. The data of mental science no less than the data of physical science are provided in and through experience. The inner or subjective state of consciousness which we call the perceiving of an object is every whit as much a reality of experience as the external reference to the object of perception. Indeed, they are integral parts of the same experience regarded from different points of view. In the one case the reference is outward to the object, in the other case it is inward to the subject. The science of psychology (apart from the metaphysics of the subject) deals with the concatenation of items of experience from this latter, that is, the subjective point of view. It is concerned with antecedence and sequence as they obtain among states of consciousness—that is to say, as they are observed to occur apart from any consideration of causal activity in the metaphysical sense.

But it may be urged that in its subjective aspect experience is a purely individual matter. It is mine or yours or another man's as a wholly private posses-

sion. I cannot get at your states of consciousness, neither can you get at mine. How under these conditions can we possibly elaborate a scheme of scientific interpretation? How can we obtain materials for anything like an ideal construction of social validity?

I return to the illustrative example of a rose-bud and half a dozen people. Each has a perception of the flower, and, just in so far as this is a purely private and individual experience of the passing moment, it is subjective. It is something that wholly concerns his own state of consciousness; but in so far as that self-same perception has a reference which corresponds to the like references of the other five persons, it is objective. There is, however, a different kind of reference on which, as a matter of experience, we guide our actions in our intercourse with our fellow-men. This reference is to a subjective aspect of our neighbour's perceptions analogous to that which is for us a purely private and individual matter. It is true that no one of us can have direct and first-hand acquaintance with the states of consciousness of any other being; but it is also true that no one of us can have such acquaintance with another man's object of perception. In the latter case we assume a corresponding reference which is amply

justified throughout the whole of our social intercourse. So, too, in the former case we assume corresponding states of consciousness. To employ Clifford's phrase, we endow our neighbours with "ejects"—that is to say, independent centres of corresponding subjective reference. This forms part of the ideal construction of psychology, which is thus, and only thus, raised to the level of a science with opportunities for comparative study. Mental science thus deals with the antecedences and sequences which obtain among ejective states of consciousness having correspondence of social reference.

I desire now to render clear the naturalistic method of interpretation within the strictly psychological field of inquiry. We have seen that physics as a science, setting aside all conceptions of causal agency, deals with its phenomena in terms of configuration. It says, Given such and such a configuration, these specific movements will be found to occur, if experience in the past is a trustworthy guide to experience in the future. So, too, does naturalistic psychology deal with configuration of items of experience in their subjective aspect. It too says, Given such and such a thought-configuration, these specific movements in the field of consciousness will occur. It too excludes all conceptions of causal

agency, dealing simply with the facts of mental sequence.

Now obviously this is a piece of ideal construction. It is at present quite impossible to evaluate what may be termed the accelerations in consciousness. The most we can say is that, as a matter of naturalistic belief, *if* we knew all the items which constitute a psychological disposition, and *if* we could assign to each a numerical coefficient, and *if* we could also assign values to the accelerations which fall under the categories of association, interest, and so forth, then we could foretell the exact manner in which the mental configuration would change. In point of fact we can do nothing of the sort. Nevertheless, this may be the ideal goal towards which psychology is working with only limited powers of realising its ideal. Let that pass, however. Grant the naturalistic assumptions, and see how such a psychology deals with the phenomena of volition. I say "phenomena of volition" advisedly, since it is only of phenomena within the conscious configuration that such a psychology takes cognisance. We must remember that the field of conscious experience is only a minor configuration (where the doctrine of concomitance holds good) within a wider physical and physiological configuration. On these terms we can accept presenta-

tions from the wider configuration of the world around us within the narrower configuration of our own private experience.

Take now a simple case of voluntary action. I see a picture hanging awry and set it straight. All that I am conscious of at the moment is perhaps a sense of dissatisfaction at its position, followed by the performance of the requisite movements of hand and arm. If I pay more attention to what occurs I notice that the movements are preceded by a more or less complex disposition which includes a preparatory anticipation of their performance, and which constitutes the intention to execute the action. There is first a mental disposition, accompanied by a representation of the end to be attained; there is then a presentation of the end as attained. There may be some strains and tensions which give rise to a sense of effort; and in more complex cases of volition there may be between first and last an indefinite number of intermediate stages which we speak of as the means by which the end is finally reached. But every stage is susceptible of a similar analysis into an intermediate end first anticipated and then realised, with some sense of effort thrown in. *Voila tout.* A conscious configuration which we call the intention is the only known antecedent of the conscious configuration

which we call the fulfilment. Why the configuration changes in this particular way we do not know; it is to be accepted as part of the constitution of nature. In the doctrine of the ego, as formulated by naturalistic psychology, the soul or mind is simply the name which we apply to a sequence of such configurations in constant relation with a wider configuration which we term the environment.

It may be well to expand a little more fully this naturalistic account of the phenomena of Volition. Professor Münsterberg shall be our accredited guide. It should, however, be distinctly understood that, in his work *Die Willenshandlung*, he bases his analysis of the act of will on a strictly scientific treatment of psychology—one from which teleology is resolutely excluded. His later publications show that he fully realises the importance of teleology in the drama of human life as viewed from the standpoint not of psychology but of history. Here an interpretation going beyond the generalisations of psychology as a natural science is, in his view, essential to a philosophical treatment of the interaction of human wills and purposes. Remembering this, let us first take note of the scientific foundations on which he builds. "Modern psychology," he says, "designates the ultimate irreducible constituents into which the con-

tent of consciousness may be analysed as sensations, ascribing to sensations a quality, an intensity, and a tone of feeling which expresses their relation to consciousness. But if sensation is the element of all psychical phenomena, and if, on the other hand, the will, so far as we are concerned with it [we must note this reservation], is only a phenomenon in consciousness, it follows necessarily that the will, too, is only a complex of sensations." Consider a simple example. I see an acquaintance, and wave my hand in greeting him. All that I am conscious of at the moment is perhaps that I just execute the movement. But suppose I execute a rather more difficult movement and pay attention to what occurs in consciousness, making the movement slowly and deliberately. There are perhaps some feelings and tensions in the head. Apart from this, each movement is preceded by an idea or anticipation of the muscular contraction before the actual attraction is felt to occur. This constitutes the impulse to the movement in question. In all such cases, says Professor Münsterberg, "I perceive in the first stadium the more or less distinct, more or less clearly represented, idea of the end; and in the second stadium I have an impression of the end as attained. That alone is the type of the external act of will." "In order that the desire of an

attainable object pass into the corresponding act of will, neither more nor less requires to be added than just the carrying out of the desire, so that the idea of the end may be completed by the perception of its attainment. . . . The liveliest feeling of practical freedom cannot alter the fact that the will itself is nothing more than the perception (frequently accompanied by associated sensations of tension in the muscles of the head) of an effect attained by the movement of our own body along with an antecedent idea of the same effect drawn from imagination, *i.e.* in the last resort from memory, this anticipated idea being given as feeling of innervation when the effect itself is a bodily movement."

But how does an idea or anticipation of a desired movement come to precede its fulfilment in act? We must remember that all our voluntary movements are the results of the compounding and recompounding of automatic responses which have been brought under control—the control of the will, which has, however, turned out to be the control of grouped sensations or ideas. I have many times performed such a voluntary act as greeting my friend with a wave of the hand. The sight of my friend therefore calls forth two things, the idea of waving my hand and the execution of this act of greeting; in other words,

first the ideal and then the actual completion of the situation. Both are the determinate results of the impression I receive. But " the former process takes place by the shorter way of the association-paths in the hemispheres; the latter requires first to be conducted to the muscles, the inertia of the muscles has to be overcome, the contraction to be actually produced, the sensory nerves to be affected, and the sensory stimulus conducted back to the cortex. All this takes an appreciable time, and the sensory stimulus arrives accordingly considerably later. And now," says Prof. Münsterberg, " we see clearly why our feeling of innervation precedes the perception of the actual movement. In it, as the constant signal of movement (a signal that is also the actual counterpart of the movement), we involuntarily believe that we see the movement's cause. This is the type of voluntary action from which all other forms may be derived." No matter how great the complication may be, an impression together with the total complex of associated ideas which it calls into play is the conscious precursor of the voluntary act which is by them and by them alone determined. Here then, as I said above, a conscious configuration which we call the intention is the only known antecedent of the conscious configuration which we call the fulfilment.

In the doctrine of the ego, as formulated by naturalistic psychology, the soul or mind is simply the name which we apply to a sequence of such configurations.

I can best indicate the nature of the opposing doctrine of the ego by quoting some passages from a spirited criticism by Professor Andrew Seth (now Pringle-Pattison) of Dr. Münsterberg's account of volition. After noting, seemingly with approval, the dynamic quality which all sensations and ideas possess, he urges that "in the very act of emphasising movement and the dynamic aspect of ideas Münsterberg eliminates altogether the notion of action or activity." Ideas "go off," or explode, as it were, in movements of their own accord. There is first the idea of the movement as in contemplation, and secondly the perception of the movement as executed. In other words, there is a series of happenings somehow passing before us, but no real activity, no real actor in the whole affair. In all so-called action we only seem to act; a sequence of ideas exhaust the phenomena of will. The conscious subject is reduced to an inactive spectator of these psychological happenings, which are themselves the inert accompaniments of certain transformations of matter and energy.

"Now I do not hesitate to say," he continues,

"that this conclusion is in the strictest sense incredible; no amount of so-called 'evidence' in its favour would avail to make it even momentarily believable." The whole thesis is vitiated by a fundamental prejudice, namely the "foregone conclusion that the conscious life is analysable without remainder into ideas or presentations. Evidently if phenomena or *objects* of consciousness are alone to be accepted as facts, then all real activity on the part of the subject is necessarily eliminated; the subject remains only nominally as a static impersonal condition of the series of events. If we insist upon phenomenalising the act of volition, doubtless all the phenomena we get are the ideas that precede and the perceptions that follow, with perhaps some feelings of tension in the head thrown in. But does it not require some effrontery to offer us this antecedent, concomitant, and sequent *ideas* as an account of the volition itself? . . . As M. Fouillée says, the physiological psychologists might fill volumes with their analysis of the sensations which accompany the voluntary act without touching the essence of the act itself."

Now what are the characteristic features of this criticism? First, that consciousness, as subject, stands apart from the objects which are presented to

it. It is not merely a stream of which presentations are constituent elements; it is an independent entity for which these presentations have value. Secondly, the subject, or the ego, is a source of activity; and the essential thing in volition is that it is causally related to this central activity which is exercised by the subject. But, I take it, that Professor Münsterberg expressly excludes such interpretations. "For our investigation," he says, "limited as it is to facts [*i.e.* to a presentational scheme] the will is a phenomenon like other phenomena; and accordingly we have only to ask in what it consists, what regularly precedes it in consciousness and what follows it." The will as motive power, supposing it to exist, does not fall within the field of consideration or the selected universe of discourse. He expressly says that the will, *so far as we are concerned with it*, is only a phenomenon in consciousness. Elsewhere, in publications subsequent to Dr. Pringle-Pattison's criticism, he fully admits—nay, contends, as I understand him—that outside and beyond the province of psychology as a science there is abundant scope for a teleological treatment of the will. If these facts be so, then the distinction between Dr. Münsterberg and his critic is that between a naturalistic and a metaphysical interpretation. Just as in physical dis-

cussions all reference to force as a motive power is, for science, ruled out of court, and everything is explained in terms of antecedence, coexistence, and sequence, so too in psychological discussions all reference to will as a motive power is, for naturalistic science, ruled out of court, and everything is explained in such terms as Dr. Münsterberg employs with a rigidity of limitation which is admirable. This is by no means to assert that the metaphysical interpretation is incorrect or invalid, within its appropriate universe of discourse. It is only a protest against the commingling of two essentially different modes of explanation of the same facts.

"One thing," says Dr. Pringle-Pattison, "is certain, that to resolve the fact of conscious experience into a sequence of presentations or conscious phenomena is to omit the vital characteristic of all consciousness." What is that characteristic? It is the purposeful unity of the subject as a causal agent. But, as we have seen, the outcome of all modern tendency in physical science is just to do this very thing —to eliminate the conception of causal agency. Psychology, as a science, is simply following suit in its own sphere of inquiry. It endeavours to formulate some, at present rather indefinite, laws of the antecedence, coexistence, and sequence of mental

phenomena. If it be wise it will not deny the existence of causal agency; within its proper limits it has no right either to deny or affirm; it should be content to assert that, if it exist, it is beyond the purview of a science which accepts the restrictions imposed by modern methods of investigation.

On these terms we may accept, in the attitude of belief, the naturalistic doctrine of the ego, that what we call the mind is, from the restricted point of view of scientific psychology, the name we apply to a sequence of mental configurations. But—it can't be proved! Never mind that. Some day it may be proved. And in any case to believe more than can be reduced to actual demonstration is not only a characteristic of human nature, but often one of the prime conditions of progress. Are we, however, to be restricted to this particular form of belief? This question brings us back to Prof. Pringle-Pattison's contention that there is a causal agency underlying the sequence of mental configurations. One may only appeal to experience to say whether he is right or not. My own experience, for what it is worth, assures me that he is amply justified in his contention. I cannot do away with the conviction that there is something within me which unifies and relates and orders the configurations, something which is the

source of my conception of causal agency. What shall I call this something? Well, it is what I understand by *purpose*. It underlies all such manifestations as are exemplified by my writing this essay. Can I prove the reality of this existence? Perhaps not, to one who roundly denies that he has any such experience. I none the less accept it in the attitude of belief, and claim the right to found belief on this aspect of my experience as freely and fully as in the sphere of my scientific convictions. For I contend that it is an ideal construction founded on experience. I confess that the purpose of my life seems to me the most intimate and fundamental reality of which I have any knowledge. But I admit, nay I contend, that the existence of such a unifying agency is not a scientific conception. It is not a phenomenon or presentation, though it is manifested to others through presentaions. It is, if you will, a postulate of reason that underlying my own actions and those of my neighbours there is in each case a causal purpose; but in them I cannot get at it, save in so far as it is manifested in presentational form. Through these manifestations my purpose and theirs come into all the varied relationships of social life. I do not see how history can be treated rationally save on the basis of such a belief.

Naturalism, however, proclaims that I am just a little bit of nature, differentiated from the rest; that I am a minute cluster of phenomena in relation with the total remainder of phenomena; that I am a tiny, if somewhat complex, configuration under the influence of the major configuration of the universe. So be it. I accept (once more I repeat in an attitude of naturalistic belief) this oneness with nature, this postulate of the scientific reason, that I am, physically, of the same order of being as the solar system and the universe at large. But if this be so, why should I suppose that the causal agency which, as purpose, underlies my own private and peculiar configuration, is of a different order of being from that of which nature at large is a manifestation? Just in so far as I *am* one with nature, and therefore in physical relationship with other manifestations in terms of matter and energy, is the purpose of my being one with the purpose which underlies the manifestations of nature, and am I in spiritual relationship with a wider and richer purpose which is thus manifested.

This is an ideal construction. But the value of an ideal construction in science lies in its application to the concrete cases which are presented to experience. With regard, therefore, to an ideal construc-

tion in terms of purpose, the important questions are these: (1) Is it valid in reason? (2) Has it value in its application to life? An appeal to experience can alone afford an answer to the latter question. A great number of those who have endeavoured consistently to apply it assure us that they have found it of inestimable worth. This point, however, falls outside the field of my present thesis. It must suffice to say that, granted its validity in reason, by its worth for human life it must stand or fall.

X

GENETIC PSYCHOLOGY

PROFESSOR SULLY tells a story of a little girl who stole softly into the dining-room after dessert, not noticing that her elder sister was standing at the bookshelf in a dark corner of the room. The little girl took a bunch of grapes and tip-toed towards the door; but before she reached it she paused, then returned to the table, replaced the grapes on the dish, and left the room empty-handed, murmuring softly, "Sold again, Satan!"

It seems a pity to spoil a good story by adding philosophical reflections. But my object in introducing the incident is to draw attention to the fact that the girl had attained and passed a critical point in mental development. The *significance* of an action was seen in the light of an ethical principle embodied for her imagination, or at any rate symbolised in her speech, in satanic form. The Prince of Darkness was not actually present to sight or touch or any mode of sensory experience. He formed no part

of the concrete situation. But his name stood for something which was there in the mind of the child, and in relation to which the act was different from that which it would othewise have been.

That Satan himself is an ideal construction may not be in accordance with current beliefs, but that a system of ethical principles comes under the category is not open to question. When once such an ideal construction is framed the particular act is not merely taken at its face value for the satisfaction of the impulsive tendencies of the passing moment; it has a new and wider significance in that it possesses worth for the development of character. Each one of us who is worth his salt forms some conception of the ideal self he would fain be in act and deed, and of the ideal community to the realisation of which he desires in some degree to contribute.

In what way can we describe on naturalistic grounds, in accordance with scientific modes of interpretation, the genesis of such ethical ideals? in what way the genesis of the ideal constructions which we have seen to be so important in the explanations of nature afforded by science? An answer to these questions, so far as an answer can be given, is supplied by that which is itself an ideal construction, namely a doctrine of mental evolution. In some way

naturalism has to trace a series of progressive stages from the instincts of the lower animals to the conceptions of the philosopher.

As the outcome of inherent protoplasmic properties there occur in plants, and in the more lowly animals, certain "tropisms" or specialised modes of responding to gravitative attraction, to moisture, or to light. The sunflower turns to the sun, and in the cottager's window-garden we see how strongly light influences the direction of growth; but the roots and rootlets turn away from the light and grow towards the moister portions of the soil. The plant which has grown from a seed which has lodged in a cranny of the wall bends upward and grows in a direction opposite to that of gravitative attraction; but, if the seed be placed in the neck of a revolving bottle, the stem will grow out horizontally. The influence of the gravitative configuration is no longer in one uniform direction. Although there is some difference of opinion, few interpreters of organic nature regard these responses as in any way under the guidance of consciousness. It must be admitted, however, that the criteria of the presence of consciousness in the more lowly forms of life are hard to formulate and still more difficult of application.

But somewhat higher in the animal scale, when a

nervous system is clearly recognisable, there are seen the more complex responses which are termed instinctive. According to definitions current among those who approach the study of these questions from the biological side, the leading characteristic of instinctive behaviour is that it is performed independently of the guidance of individual experience and before there are opportunities of acquiring any such experience. The last clause of this definition only applies, however, to the *first* performance of such inherited modes of behaviour in the case of those animals whose subsequent behaviour is under intelligent guidance; for it is clear that this first performance may afford the means of acquiring the necessary experience for such guidance. When the newly-hatched chick pecks at small objects within striking distance, or the newly-hatched duckling placed in water swims, there is no individual experience at the back of the first performance. Certain grouped stimuli set agoing certain nicely co-ordinated responses, and this seems to be due to the organic inheritance of a suitable physiological mechanism.

Recent researches in the field of tropisms, reflex action, and instinct have had for their object the study of those modes of response which are thus distinctively organic and physiological, and are so far

independent of experience as to be prior to its controlling influence in their initial performance. The behaviour need not be observed till some time after birth; in many cases it must of necessity be deferred till the organic structures and the physiological mechanism have reached the requisite stage of development. Thus the flight of birds is probably in the main instinctive; and there are well-marked instincts which only appear with sexual maturity. But just in so far as performance is prior to individual experience *ad hoc* is it regarded as instinctive. And it is, by those whose views I seek to interpret, held to be the result of natural selection which has led to the survival of those who behaved in certain specific ways in response to environmental stimuli and the elimination of those who failed so to behave. Hence instinctive behaviour may be said to owe its existence to its having "survival value." As such its mode of origin is to be explained on purely biological principles of interpretation.

But those animals which afford examples of such instinctive behaviour give evidence also that on occasions subsequent to the first performance, the behaviour may be modified, may be carried out with increased vigour, may be checked, or may be altered in some of its details so as to meet the circumstances

of the case. Thus the newly-hatched chick pecks at any small object within striking distance, and so far its action is purely instinctive, but soon it responds by pecking only at certain objects. Many things, such as lady-birds and other nauseous insects, are left alone; experience has shown them to be distasteful. Here we have apparently evidence of selective intelligence. Instinctive behaviour is prior to individual experience; intelligent behaviour is due to the guiding presence of such experience. It involves the so-called influence of mind upon matter.

Now if there is one feature which is essentially characteristic of the popular conception of the influence of mind in the conduct of affairs it is that consciousness, as controlling, stands in some way apart from the organic happenings over which its control is exercised. How far, we may ask, and in what sense is this popular conception valid? Take any simple case of accomodation to circumstances as the result of the teachings of previous experience—let us say the avoidance of nauseous insects by young birds. Naturalism contends that the experience is the concomitant or accompaniment of certain physiological processes in nerve-tissue. Assume, then, that this conscious experience is the concomitant of the nervous processes involved in the instinctive pro-

cedure as such. How can that which is a mere accompaniment in any way augment, inhibit, or modify that which it accompanies? How can it be more than an epiphenomenon? It seems to me that, on this assumption, intelligent guidance through the teachings of experience is, for naturalism, simply incomprehensible. But there is an alternative hypothesis open to naturalism. Still holding firmly to its doctrine that mental states and physiological processes in nerve-tissue are concomitant, it may contend that the organ of experience is differentiated from the organ primarily concerned in instinctive behaviour. It is true that biologically we have to deal with what appears to be a single and continuous organ—the brain and spinal cord. But there are no established facts in physiology which prevent our accepting the doctrine that within that organ a control system, which is the physiological embodiment of what for the student of mental science is experience, has been differentiated from the centres concerned in instinctive behaviour, and thus, in a sense, stands apart from the organic happenings over which its guidance is exercised. For naturalism this differentiation is, I conceive, the essential condition of the rise and growth of intelligence as a factor in the upward progress of animal life.

It is not necessary to enter in any detail into the more distinctively biological aspect of the study of instinct. From our present point of view the distinguishing feature of instinctive procedure lies in the fact that the behaviour thus characterised is, on its initial occurrence, prior to and independent of individual experience. It wholly depends, as such, upon how the automatic centres have been built through heredity, and this in turn depends upon what I have spoken of as "survival value" under natural selection. But the automatic centres are in closest possible touch with the differentiated control system which is the organ of experience. And the performance of an instinctive act so stimulates the centres of intelligent control as to afford the primary data of experience. In this sense instinctive behaviour is probably accompanied by vivid consciousness. And from the standpoint of genetic psychology it appears to me that the really important contribution which the study of instinct offers for our consideration is this: that in any given case of hereditary behaviour what we may term an instinctive situation is presented to consciousness, as, for the individual, a primary unit-complex of experience, and that, as such, it is developed independently of any guidance in terms of experience. By the situation as pre-

sented to the environing consciousness I understand the whole of the initial stimulation, including both external and internal factors, such as the sight of food on the one hand, and hunger on the other hand; the net results of the behaviour as the situation develops; for example, the seizing and swallowing of food, and the satisfaction or dissatisfaction which is attached thereto. Psychologists analyse the instinctive situation. But I conceive that it is presented to consciousness as one developing whole. And the mode of its development is an organic legacy; it is essentially a flow of physiological process in the automatic centres; but it entails a flow of consciousness in the differentiated centres of intelligent control; and this flow of consciousness in its entirety, within a given situation, I am disposed to regard as a primary datum in individual development.

One of the most perplexing and refractory problems which the earlier psychology essayed to solve is by what process of coalescence and elaboration isolated sensations could build themselves up into the complex wholes of perception, and how these could relate themselves with the similarly-built complex wholes presented to consciousness when active movements were carried out. It assumed that the several sensations which may be distinguished through the

application of a difficult and prolonged process of analysis and abstraction, were independent psychological units separately given, and sought to render an account of the manner in which these mental elements threaded themselves on the strands of association. A biological treatment has more and more clearly tended to emphasise the fact that the individual organism comes into the world as a going concern, the recipient of groups of stimuli giving psychological net results on the one hand, and capable on the other hand, on purely organic grounds, of complex modes of behaviour which supply also their net results, the two sets of net results coalescing so as to constitute felt unity-wholes. It has thus tended to relegate many of the problems of mental development to biology, and has come to regard association itself as in large degree dependent on factors which are primarily organic and physiological.

On this view, then, instinctive procedure—using this phrase in a broad sense to cover all more or less complex hereditary and automatic responses—presents to experience, embodied in the centres of intelligent control, ready-made situations. That is the first act of the mental drama in individual life. Later acts may be more or less under the guidance of experience; for on the subsequent occurrence of like

situations, under substantially similar circumstances, these are dealt with in accordance with the meaning which their predecessors had acquired.

This word "meaning," used in a somewhat specialised sense, is a comparatively new importation into psychology. Let me illustrate what it implies by a simple concrete case. A chick, in virtue of its instinctive tendencies, pecks at a small moving insect—a lady-bird—seizes it, throws it on one side, shakes its head, and wipes its bill on the ground. That is the way the situation develops. On the following day it sees such an insect, and may run towards it; but it does not take it into the bill, though it may perhaps wipe its bill upon the ground. The lady-bird has acquired meaning, and in accordance with this meaning the behaviour of the chick is modified. Why not say, as we used to say, that the sight of the insect suggests its nauseous taste, and that the memory of its unpleasant character makes the bird refrain from pecking? Because, in all probability, that is not just what goes on in the mind of the chick, though it does express certain salient features disclosed by our analysis; because it is more likely that the recurrence of the initial stages of the lady-bird situation serve to revive the rest of the situation, including much besides the nauseous taste,

if taste it be in the form of a state of expectancy. Be this as it may, the word "meaning," as a general term for what is suggested as the outcome of previous experience, is a convenient one. In this sense, for the child in the nursery, as for the developing animal, the things in its environment are day by day acquiring fresh and fuller meaning, each reviving that part of previous experience which is relevant for practical behaviour.

One can, however, scarcely too strongly emphasise the fact that in passing from biological responses and reactions in the sphere of instinct, as above defined, to intelligent behaviour founded on experience, we introduce a wholly new but supplementary order of values—values not only in terms of organic survival, but also in terms of conscious satisfaction. That situation which has afforded pleasure or has been attended with some form of satisfaction is redeveloped when occasion arises through the presentation of its earlier stages. But that situation which has led to painful results, or from form of discomfort, is not redeveloped. If the earlier stages be presented, the unsatisfactory behaviour is inhibited. The two sets of values—survival values and satisfaction values—are, however, so often and of necessity so predominantly consonant—their inter-relations

are so many and so close—that we are apt to forget that they are logically distinct. Physiology, as such, knows nothing whatever of those pleasure-pain values which for the psychologist are essential. They form no part of the ideal construction of physiology: they are dominant factors in the ideal construction of psychology.

And it is here, just where the strictly biological and the distinctively psychological factors begin to interact, that the difficulties of analysis make themselves felt. I have distinguished between the automatic system, the functioning of which is determined entirely by biological values in terms of survival, and the control-system, the functioning of which *in its psychological aspect* is determined entirely by a different order of values in terms of felt satisfaction. The outcome of the one is instinctive behaviour; the outcome of the other is intelligent behaviour. But both are dependent on heredity. And it is therefore, I think, essential to distinguish, in our ideal construction, between two orders of heredity: first, that which obtains within the automatic system, and which thus determines the nature of the hereditary responses; secondly, that which obtains within the system of intelligent control, and which thus determines the nature of the hereditary likes and dislikes.

For analysis these are independent each within its appropriate sphere; but they are developed within the same organism in close synthetic relationship.

At the outset of individual development instinctive and automatic responses are due to the purely biological order of heredity; but their results are reflected in experience, and therein are subject to the psychological order or heredity, so that the controlling influence of the environment is determined by feeling-tone and values for consciousness. If then we speak of the development of a situation in conformity with the satisfaction it affords, as in accordance with the psychological end, and its development in conformity with the preservation and conservation of the race as in accordance with the biological end, the salient fact is that the two ends are consonant. This has, of course, been fully recognised by evolutionists from Herbert Spencer onwards. I will not here lay stress upon the noteworthy fact, which has not perhaps been sufficiently recognised by the Lamarckian school of evolutionists, that this consonance of biological and psychological end is admitted to be the outcome of the survival of those in which the consonance obtained and the elimination of those in which it was absent—that is to say, is admitted to be dependent on natural selection. I would rather lay stress upon

the fact that this consonance affords a striking link of continuity between the more distinctively biological and the more distinctively psychological factors of the genetic process.

The relation between the two has been well brought out in Professor Groos's discussion of the so-called play of animals. Indeed, such play admirably illustrates the twofold influence of heredity, for on the one hand it is founded on unquestionably instinctive modes of behaviour, and on the other hand it not less obviously appeals to an innate sense of satisfaction. Why do animals begin to play and keep on playing? From the psychological point of view because they like it, from the biological point of view because they thus gain practice and preparation for the serious business of their after life. But why do they like it? Because under natural selection those who did not like it, and therefore did not undergo the preparatory training and discipline of play, proved unfit for life's sterner struggle, and have been therefore eliminated. I have contended that inherited modes of behaviour present to consciousness ready-made situations which develop automatically on biological lines, and that the rôle of intelligence is to lead to modifications in their redevelopment in accordance with their psychological values. I have

also called to remembrance the fact that in the animal world, under normal conditions, these psychological values, with their appeal to feeling, are consonant with biological values in terms of survival. Throughout the course of mental development in the perceptual sphere there is a constant interaction between the two factors broadly classed under the heads "instinct" and "intelligence."

I would restrict the term "intelligence" to the guiding factor in behaviour, as the result of experience, when it falls within what Dr. Stout has termed the perceptual sphere. Here any given situation of practical life is developed in accordance with the meaning which like situations have acquired in the course of their performance. The situations are not analysed: the results of analysis are not rebuilt into ideal constructions by a process of intentional synthesis with a view to explanation and interpretation. That is the outcome of ideational process and conceptual thought.

Throughout the whole range of perceptual development as it is seen in the lower animals there is progressive integration and differentiation of the unit situations, always on essentially practical lines, always in closest touch with active behaviour.

Even perception itself, as genetic psychology has helped us more fully to realise, is dependent on acquired habits of action. Perceptual meaning and value are ever dependent on some activity directed toward that which is so perceived. All differentiations within the presented situations are due to the call for some directed behaviour, are due to the demand for some focussing of active manipulation. Thus is the mouse differentiated for the practical interests of the kitten. And all integration of diverse situations is due to their assimilation in terms of like modes of behaviour in dealing with them, in terms of the similar responses which they evoke. Thus there is an integration of the situations of so-called play and earnest. But in perceptual process, far as differentiation may be carried, it never reaches the stage of intentional analysis; and, far as integration through assimilation may be carried, it never reaches the level of intentional generalisation. These are the results of ideational process.

The influence of the terms we employ, closely connected as it is with our early training, is often deep and abiding. It has been a special merit of Dr. Stout's treatment of psychological topics that he has emphasised, so clearly and in so many ways, the

fundamental distinction, as I conceive it to be, between perceptual and ideational process. As he himself has pointed out, one of the great difficulties in the way of its general acceptance is due to the fact that the existing terminology grew up at a time previous to any serious attempt to render clear the distinction. Some of my readers may remember the almost pathetic words in which Dr. Stout laments the misleading influence of the terms we are at present almost forced to employ. If I may be allowed slightly to modify his statement without, as I believe, introducing anything foreign to his thought, his contention is that " human language is especially constructed to describe the mental processes of human beings [in ideational terms], and this means that it is especially constructed so as to mislead us when we attempt to describe the workings of minds which differ in any great degree from the human " and even the workings of our own minds on the perceptual plane. "A horse having had a feed at a certain place one day, stops of his own accord at that place on a second journey. People say that it remembers being fed here before, and infers that it will be fed here again. In all probability these words with their human implications [on the ideational plane] are quite misleading. Suppose that the master of the

horse is a bibulous person, who takes a drink as a matter of course whenever he comes to a public-house on the road. In order to do this he need not go through the process of [looking back retrospectively on his past experience and in this sense] remembering that he has had a drink at a public-house before, or of [drawing a definite, logical conclusion and in this sense] inferring that he can have a drink at a public-house again. He simply has a bias to stop at a public-house whenever he comes to one. Probably the horse's act implies just as little of remembering or inferring."

It will be noticed that the difficulty which Dr. Stout indicates does not apply only to the mental processes of the horse, but also to some at least of those which are characteristic of his bibulous master. No doubt, taking men and women as we find them, there is the closest interaction between ideational and perceptual process, just as there is between instinctive and intelligent procedure. But there is, I conceive, an analogous relation. Just as the instinctive factor provides data which intelligence deals with so as to shape it to more adaptive ends, so does the perceptual factor provide the more complex data which, through ideational process, are raised to a yet higher level in rational conduct. And in both

cases notwithstanding, nay, largely in consequence of, the closeness of the interaction, it is the business of analysis to distinguish with the utmost clearness the essential features of the constituent factors.

I take it that the leading characteristic of perceptual process is the dealing with situations as wholes in their unanalysed entirety. When the integration of which I have spoken has been carried far, any relatively new situation is assimilated to the past experience gained in similar situations wherein certain salient features have been differentiated through their intimate relations to practical activities. The associations thus begotten are not associations between separate ideas, but in every case essentially between the situation and the practical behaviour it calls forth. Even this expression savours too much of analysis. Let us rather say that the type of association distinctive of perceptual process is that between an early phase of a situation and the succeeding phase, so that what is suggested in any given case is a mode of development of the situation as a whole through practical behaviour. That is the essential feature of the doctrine of meaning in perceptual process. It is meaning in terms of a specific development of the situation as a whole; it is meaning closely bound up with a felt impulse to act

in a certain way; it is the meaning which attaches to the public-house as the result of practical experience on the part of the horse and of his bibulous master.

Now it appears to me that recent researches all point to the fact that the mental processes of animals are mainly—I do not say entirely, though I myself still incline to that opinion—but at all events mainly, on the perceptual plane. They tend to show that animals, even the monkeys, deal with situations as complex unity-wholes. The method of learning is chiefly dependent on practical behaviour which, carried out with varied and persistent—often restless—activity, leads the animal unsystematically to stumble on new associations between such behaviour and the situation within which it arises. But it also appears to me that a very large proportion of human process is predominantly upon the perceptual plane. I say "predominantly" because even this section of human activity is inevitably influenced by the ideational section which is superinduced thereon. And there is, I repeat, no little difficulty in determining its range, as perceptual, just because our psychological language almost necessarily leads us to describe it in ideational terms—the terms begotten of comparison, analysis, and synthesis.

It is through such steps, and such steps alone, that

on the basis of perceptual experience systems of knowledge can be built. This is the product of ideational process. It involves an ideal or schematic construction. And when situations are viewed from the standpoint of a system of knowledge their salient features have not only "meaning" for practical behaviour, but also "significance" in relation to that system. They are apperceived as particular examples which illustrate some general scheme or principle. And it is here that psychology comes into touch with normative science. No doubt normative science, as its name implies, deals with standards of reference—in ethics, for example, with standards of "ought." But this is only an implication of the fact that the particular act is viewed in its relation to an ethical scheme of conduct. Impulses arise within the situations as they occur and as they are dealt with in and for themselves. But motives, as the term is used in ethics, imply the relations between these several situations and a system of ideals. Only on the ideational plane do there emerge considerations looming up beyond the situations into a prudential, moral, or other scheme; behaviour is thus raised to the level of conduct; and a situation is developed, not only in accordance with the impulse-value arising therein, but in accordance also, and in

greater degree, with the motive-worth for a system.

In this brief sketch I can scarcely hope to render clear and convincing the distinction between perceptual process on the plane of intelligent behaviour and conceptual process on the plane of rational conduct. And, no doubt, to some the difference between "meaning for practical experience" and "significance for systematic knowledge" may not be obvious—or may appear too slight to bear the stress I have laid upon it. None the less, I regard it of cardinal importance as affording one of the criteria of wholly different stages of mental development. How can I help the reader to get the necessary point of view? Perhaps an illustration from such games of skill as tennis, or cricket, or golf may serve. For most of those who simply play with more or less success but without troubling their heads about the theory or the science of the game, their skill is so far on the perceptual plane. The way in which the tennis ball comes off the opponent's racket and skims over the net; the manner in which the cricket ball leaves the bowler's hand and pitches; how the golf ball lies, the look of the course for an approach shot, the slope of the green for one's putt—all these are full of meaning for the practised player. As the result of previous experience, each immediately suggests the requisite

response in play. There is a direct association between such a situation in the game and the appropriate action. So, too, every movement of the button on his adversary's foil means for the fencer such and such a guard. There is no time to think out the right parry. Skill depends on a body of experience begotten of constant practice, and a man may be a first-rate exponent without having any systematic knowledge in terms of which he can explain how and why and on what principles he acts in this or that particular way. It is simply the net result of having so acted in hundreds of similar situations. And the most skilful player is the one whose action is the natural and spontaneous outcome of the circumstances of the moment. The successful driver at golf walks up to the tee, takes his line, and smacks the ball a couple of hundred yards. If one has to think anxiously about the proper stance, the latest hints as to how to correct a faulty swing, the paramount necessity of keeping the eye on the ball and away from the hazard in front, and so on, the chances are against him; that way foozling lies. Of course I am not urging that the good player must be ignorant of first principles in the art and science of golf. In his rational moments he has probably paid some attention to them; but he need not know much about them

to be a good golfer, and the less he thinks of them when he is making his stroke the more liable is he to feel that he is on his game, that it is his day, and that somehow he cannot go wrong.

Now let us suppose that he wants to know, for his own satisfaction or to explain to others, how the game should be played. Improvement in the art, or exposition of its rationale, is a motive beyond the enjoyment of the passing hour. What must he do? He has to analyse the strokes into the component movements which he has hitherto felt or seen as unity-wholes. He compares the stance and swing of professionals and scratch men. Amid many idiosyncrasies he finds certain essentials in each case that he can accept as a model. These he selects from the non-essentials. By abstraction and generalisation he reaches general principles. He frames an ideal of effectiveness and style; he proceeds to the application of these general principles to his own particular case, and probably finds it no easy matter; or, as a critic, to the play of others, a less difficult task. Just in so far as he is able to do so, he realises the significance of his faults—the relation of his own poor stroke to the ideal, the way the ball ought to be played, why he has sliced or pulled or skied. He has added to his practical experience a system of

knowledge. This he could never have reached without analysis, comparison, generalisation, and the application of abstract principles to the concrete case. This involves not merely perceptual but ideational and conceptual process. And of this kind of mental procedure animals, with all the wonderful skill they exhibit in so many ways, show little or no evidence.

Intelligence, then, in the perceptual sphere, embodying the coalescent re-presention of concrete situations, exercises a guiding influence over the automatic responses of instinctive origin; and this undergoes evolution to higher and higher levels in perceptual process without overstepping its limits. But in ideational process there is superimposed a further and more subtle guidance, under the influence of which intelligent procedure, based on practical experience, is itself controlled. This higher guidance involves the presence of systems of knowledge, ideals of conduct, and artistic conceptions. Just as intelligence, fulfilling its function, plays down upon instinctive procedure, shaping it to more perfect adjustment to the circumstances of perceptual life, so does reason play down upon intelligent behaviour, moulding it to more perfect adjustment to the varied conditions of rational and moral life.

According to this interpretation, there are super-

imposed upon the satisfaction-values associated with the procedure of the passing moment yet higher worth-values in reference to a more remote intellectual, æsthetic, or ethical end. In addition to the coarser emotions of animal life, there are the subtler sentiments which characterise the human being. Behaviour founded on the impulse to act arising out of the immediate situation rises to conduct dictated by motives connected with the ideals of right, seemly or prudential action in a scheme of social and it may be, spiritual existence. And if we attempt to translate all this into physiological terms, not only is there a differentiation of a control system from the nerve-centres for automatic response, but there should also be a further differentiation within the control system itself; yet higher intellectual centres being differentiated from, while preserving their integration with, those which are concerned in perceptual process. This view is substantially in accordance with the physiological conceptions of one of our highest authorities, Dr. Hughlings Jackson.

One of the most important features of ideational and conceptual process is that it not only involves new relations with the environment, but creates a new environment in which these relationships obtain. Perceptual intelligence is, in the main, receptive and

representative of a natural environment which takes form independently of the exercise of its influence. Only in a limited degree are its products in behaviour so applied as to modify and enrich that natural environment. The beaver indeed constructs its dams, the bird builds its nest, the spider spins its web, and so forth. Some amount of choice of environment, through what Dr. Ward has termed subjective selection, is also possible. But it is a characteristic feature of ideational process that it is constantly, to a much larger degree, embodying the products of its rational thought in concrete form so as to constitute part of the physical surroundings. Our books, our art galleries, our museums; our railways, steamships, and electric appliances; all the multifarious products of what we call civilisation—what are they but an environment in which the results of ages of human thought are embodied? And men are to a large extent free to choose their own environment. Subjective selection is a most potent factor in human life. One of the most helpful definitions of education is that it is that form of social ministry which brings, or should bring, the developing individual into the closest and most vital relations with his environment. To an extent only foreshadowed in the animal world does man both create and select his own *milieu*. And

this is the key-note of the higher human evolution as contrasted with that which obtains among the lower animals. It involves a transference of evolution from the organism to the social environment. It is questionable whether the average child is better equipped by natural endowment of mother wit and intellectual ability than his forefathers of Tudor or Plantagenet times. But it is unquestionable that he has opportunities to-day of exercising his powers to better advantage, since he is more fully brought into relation with a more highly evolved social system. To illustrate by an analogy, we may say that even if the mental lungs are not more highly evolved than they were a dozen generations ago, they breathe to-day a richer intellectual atmosphere. This progressive improvement of man's social heritage is one of the salient results of ideational process.

We must now revert to the question which was asked near the beginning of this section: In what way can we describe on naturalistic grounds, in accordance with scientific modes of interpretation, the genesis of ideal constructions ethical and intellectual? I have endeavoured to show the manner in which naive experience arises and influences behaviour. Assuming the existence of certain protoplasmic responses to surrounding conditions, those which have survival

value are perpetuated through organic heredity. For their grouping and integration a nervous system is differentiated, and its functioning may be accompanied by sentience. Within this nervous system a further differentiation occurs, certain centres being set apart to exercise a controlling influence over the automatic responses co-ordinated by the more primitive centres. The primary centres are those concerned in instinctive procedure; the secondary centres are those of intelligent control. In them sentience is raised to a higher level and the concomitant conscious experience is the subject-matter of mental science. The conditions of effective experience are that the conscious situation due to instinctive happenings may be revived or re-presented when its initial phases are again presented; and that there is a difference in functional action, permissive on the one hand, repressive on the other hand, according as the previous situation was pleasant or the reverse. That which is again presented is said to have meaning in terms of that which is revised or re-presented; and this cognitive meaning has the effective tone of what were termed satisfaction values. Satisfaction values for conscious experience and survival values for biological race-preservation are, however, in the animal kingdom, nearly always consonant.

The conditions of the evolution of intelligence as influential on behaviour are, on the physiological side, the increased differentiation, size, and complexity of the secondary centres, and on the psychological side the opportunities thus afforded for the coalescence of the situation revived or re-presented into an increasingly complex body of practical experience, the items of which have increasingly intricate cross-reference in terms of meaning with more varied phases of satisfaction value. All this is classified under the head of perceptual process.

But upon this, at some stage of evolution, there began to be superimposed the higher ideational and conceptual process. The physiological conditions are a differentiation of new tertiary centres in the nervous system. The psychological conditions are those modes of mental activity known as comparison and generalisation, analysis and synthesis. Hence arise those ideal constructions, whose genesis we seek, which may be regarded as mental products crystallised out of the magma of naive perceptual experience. Not that this analogy serves to do more than illustrate, and that inadequately, the manner of their genesis. They are, it must be remembered, the concomitants of physiological configurations undergoing organic changes. The way in which these exercise a

guiding influence on the functioning of the lower centres must be a specifically physiological mode of interaction; but, as such, it is in line with all that biology teaches as to the functions of a nervous system.

Now it may be frankly admitted that we do not at present know all the conditions, physiological and psychological, under which the specific mental products of perceptual and ideational process originate, and under which the control of bodily activities arises. But we have made some advance towards such knowledge in terms of a naturalistic interpretation. Granted that this is carried very much further, so as to enable us to afford an explanation of mental evolution and development in some degree adequate to the case, even then we shall be told that we have not reached the heart of the matter. It will be said that we have done no more than to describe the conditions under which certain mental products occur, but that we have rendered no account of the reason why, under these conditions, they should occur, or why they are of this or that particular nature. I would, however, again insist on the fact that naturalism does not, or at any rate should not, profess to give answers to any such questions. When naturalism has traced the antecedent conditions of the

origin of any product of nature it has performed its task to the full. Why the product is what it is and not something else neither naturalism nor science can say. The facts have to be accepted as given facts—and there 's an end on 't.

That is just where naturalism fails fully to satisfy the needs of the inquiring human mind. A further question will arise and press for an answer. Even supposing that the many gaps in assured knowledge of the conditions of the sequence implied in mental evolution shall some day be adequately bridged, is such an account, or any such account, philosophically satisfactory? We have an ascending evolutionary curve; can we, who are points in the course of its sweep, give a satisfactory account of it by looking only backward at the foregoing conditions and not at all forward to the end to which it tends? Granting that the sequence is of such a kind as to make a rational appeal to the reason which is, here and now, its final outcome, may we say that in this outcome reason is becoming conscious of itself as partaking of the nature of the underlying cause?

Or, to return to the ethical conceptions with which we started in this section, must not similar questions suggest themselves? No doubt ethics may be treated from a frankly scientific point of view. We find, as

a matter of fact, that men and women—some of them civilised like ourselves, some of them with very different social notions from ours—do form ideals of one kind or another, though we may often think them very wrong-headed. These ideals may be classified, the nature of their sequence may be described, and generalisations may be reached as to their mode of development. In all of this the treatment of ethics is proceeding on scientific lines. But the question arises, Why does a man have ideals at all? We are perhaps told that they are the natural outcome of his character and the circumstances of his life and upbringing. No doubt they are. I would not for a moment deny that in the formation of every ideal there is a chain of antecedents, the links of which we might, but often cannot, unravel. I do not deny that every man's character and personality is a synthesis of elements, the stages of which might be traced if only we had adequate insight and knowledge. But it seems to me that of this synthesis there is a cause, which for metaphysics is the will of that individual. And then the further question arises, Why, having such ideals, does a man act on them? From the strictly scientific point of view the bare fact must be accepted. The act is the sequent of the influence of the foregoing physiological configuration, con-

comitant with which is an antecedent psychological disposition. True enough. But is this an adequate and satisfactory interpretation of human conduct? Can we rule out purpose and end and the desire for their attainment as real causes of man's endeavour? I for one think not. Conduct and history lose their meaning if we do. May we not say that the realities of practical and intellectual life and of moral endeavour are the ends for which men strive?

XI

THE METAPHYSICAL POSTULATE

TO the riddles which nature propounds to us," said Lord Salisbury in his Oxford address to the British Association, " the confession of ignorance must constantly be our only reasonable answer." And the saying was hailed with acclamation; not least among those who most strenuously repudiated agnosticism. This cheerful acceptance of ignorance, however, is not the attitude of the inquiring spirit. It is true that we should always be ready to say: Here is a gap in our assured knowledge; we can only complete our ideal scheme by filling in the gap with hypothesis or, it may be, conjecture. But the confession of ignorance, though it may be an honest admission of failure, is scarcely a reasonable answer to a riddle. I have no desire to quibble over phrases and modes of expression. Lord Salisbury's meaning is clear enough. And the modesty that he desired to advocate is an altogether admirable quality. But the attitude of science towards ignorance is always

one of intolerance and profound dissatisfaction, save in so far as it affords opportunities for discovery. And even the agnostic has, I conceive, to school himself with sorrowful diligence into the acceptance of the fact that the riddle of the universe can never be answered by beings of such limited capacities as are found in man.

Whether we regard ignorance, however, with complacency or intolerance, whether a confession of failure in presence of unsolved problems is a reasonable answer to the riddles or a modest confession that so far we have guessed in vain, the fact remains that our interpretations of nature are still, and are likely long to remain, in many respects faulty and inadequate, lacking in precision and lacking in comprehensiveness, mere outline sketches at best rather than finished pictures. Even the last half-century's splendid advances in science of which we are so proud, and justly proud, have served not only to reveal how little we knew fifty years ago, but how great is the array of new problems which still await solution. It seems literally true that the more we achieve in the mastery of knowledge, the more fully do we realise the range and extent of the as yet unachieved. Must we then wait indefinitely for further and fuller achievement before we attempt to express in synthetic

form our interpretations of nature? Surely this is neither possible for the inquiring mind, constituted as it is, nor desirable. Rather should we build, as we may and can, from time to time, with the available materials for construction, remembering that when we have done our best to-day there must be many imperfections which the broader outlook and deeper insight of the future will most assuredly disclose.

At the outset of this essay I drew attention to the fact that divergent interpretations arise according as the course pursued is from within outwards or from without inwards. The purposes of human life are for primitive folk the centres of predominant attention. Continually thrust into the foreground of daily experience, they are naively accepted as the basis of all explanation. Taken for granted as given factors in social life, no need is felt to explain that, in terms of which all explanations are afforded. Nothing independent of the practical purposes of man has any interest in and for itself. If incidentally given in experience, it is regarded as a negligible factor. But gradually there arose the perception that, not only were the events which happened in the world around closely connected with human well-being, but they were also intimately connected among themselves; and a knowledge of their external inter-relationships

was found to be of value in furthering and rendering more efficient the application of human endeavour. Herein, however, lay the germs of a decentralising process. Interpretations, proceeding hitherto wholly on the method of projecting human purpose on to the plane of nature, now proceeded partly on the method of introjecting the mechanical explanations of the outer world into the life and eventually into the very soul of man. The culmination of the latter process is modern naturalism, according to which human purpose is itself completely explained introjectively as the product of an evolution whose dynamic germs were contained in a primitive fire-mist or a swarm of meteoric particles. The question therefore arises: Does the later interpretation of nature in terms of mechanism, even if we grant its premises and its conclusions, entirely supersede and render invalid the earlier interpretation in terms of purpose?

The naturalistic basis of experience then claimed our attention. This basis is afforded by our impressions and perceptions. I urged that on this plane of thought—within this universe of discourse—the test of reality is correspondence of objective reference. If this holds good not only for the individual during different modes of perception, but also for

mankind, it has complete validity for all practical purposes. I claimed for this objective reality and validity, that it holds good for experience down to its minutest details. The fire is in this sense really hot, snow is really cold, the apple is really scented and acid-sweet, the varied colours of sunset, shading through many and varied tints, are actually parts of objective existence, no less than the shape and solidity of this desk at which I write. But a percipient, actually or ideally present, is throughout assumed on this interpretation when it comes to philosophical maturity. Always and only for perception, for experience, does the validity claimed for the world of objects hold good. Before it reaches this final expression, however, the naturalistic interpretation has to pass through several stages of development. At first it is naively assumed that, since the object of experience, just as it stands, is independent of this, that, and the other percipient, taken severally, it is absolutely independent of all experience. It is real not only for us but in and for itself. For practical purposes, this additional hypothesis, though wholly unnecessary, is quite convenient; and there can obviously be nothing in the data of experience to contradict it. But when it is submitted to critical analysis, difficulties in the way of its

thorough-going acceptance inevitably arise. Sweetness and colour, for example, are clearly, it is urged, dependent on our organs of sense. These are not properties existent as such in the external object, but rather modes in which certain real properties affect us, organised as we are. Thus arose the distinction between the primary qualities existent independently of any percipient, and the secondary qualities dependent on the way in which the external mechanism affects certain kinds of living tissue in the organs of special sensation. But how come we to have any knowledge of this mechanism—this really existent matter in motion? Only through perception; only through other channels of sense. Critical analysis, therefore, pushing home its cross-examination of experience, shows that all modes of that experience stand on precisely the same footing. Primary and secondary qualities alike are in the same category as dependent on experience. All are equally valid and real on the plane of our practical dealings with the world, though some must be translated into physical terms for exact mathematical treatment. Of any independent existence, however, experience, so long as it is restricted to the data afforded by our perceptions, can give no information. Even if we postulate such an existence, as the source and origin of

our experience, it cannot be self-existent under the same guise as that under which it is manifested in phenomena. But that which gives to experience its practical guidance and its intellectual value is purpose. This cannot be directly presented to experience, though it may perchance be felt within it, or postulated as the ground of its being. May it not therefore be a rational, though not an empirical, conclusion that the underlying source of objective existence is the purpose of which it is the expression?

I then urged that the method of science is to frame ideal constructions; that in its departmental studies it extracts from the manifold of phenomena just those essentials which are necessary for its specific synthesis, and even these it reduces to their simplest expression; its generalisations are inevitably schematic and abstract; they cannot include all the detail of natural occurrences; but the system so elaborated has value because it enables the man of science to interpret the varied situations to which the ideal scheme is applicable. Throughout its interpretations it deals with antecedence, coexistence, and sequence as they are extracted in schematic form from the data which are afforded to experience. On the basis of observation physics, having translated these data into terms susceptible of mechanistic treatment,

builds in thought a configuration of range and delicacy often far outrunning the limits of observation, a configuration undergoing slow or rapid changes often in no way susceptible of direct measurement. The antecedent configuration of any given moment is regarded as the condition, or the scientific cause, of the subsequent configuration of the moment that follows. But with regard to any motive power or agency, with regard to any force as the underlying Cause of motion, with regard to any source or origin of the changes of configuration, it is and must remain, as science, silent. Such Causation lies beyond its ken. It does not enter into the scheme of scientific interpretation; it is no part of the assumptions of naturalism; if entertained at all it must be regarded as a metaphysical postulate. As Berkeley long ago said in his *Siris* (Sec. 231), "The laws of attraction and repulsion are to be regarded as laws of motion, and these only as rules or methods observed in the production of natural effects, *the efficient and final causes whereof are not of mechanical consideration.* Certainly, if the explaining of a phenomenon be to assign its proper efficient and final cause, it should seem the mechanical philosophers never explained anything; their province being only to discover the laws of nature, that is, the general

rules and methods of motion, and to account for particular phenomena by reducing them under, or showing their conformity to, such general rules."

But just as the analysis of our daily experience, in showing its close and intimate dependence in the last resort on perception, only brings into greater prominence the need of a supplementary postulate, that there is a purpose which renders it rational—nay, more, serves to disclose the fact that "there are notions embedded *in* experience, which experience cannot justify or explain" in terms of antecedence and sequence—so, too, does a consideration of the ideal constructions of science lead us to inquire how it is that these human contrivances do so helpfully symbolise what is most interesting in a world which is at any rate independent of individual perception so far as it has social validity. In brief, granting that the reality of objective experience is dependent on correspondence of reference for all normal human percipients, how is this correspondence secured, and how comes it that our rational constructions enable us to interpret not only our own experience but that of others?

Granting to naturalism that the universe of phenomena is ideally explicable in terms of configurations undergoing changes which conform to rule, the fact

remains that there are different types of configuration. So long as we are dealing with a given order all the changes are in conformity with the rules which hold good within that order. But when we pass from one order to another new rules obtain. There are thousands and tens of thousands of cases in the world of inorganic nature in which new modes of acceleration, involving new properties, come suddenly upon the scene—properties which, with our existing knowledge, we could not have foretold. Science must accept these new properties as data afforded to experience. All that we can do is to trace, if possible, the antecedent conditions of their appearance. Protoplasm exhibits characteristic properties; there are specific types of physiological acceleration; there are modes of selective synthesis elsewhere unknown. And the antecedent conditions of the natural origin of protoplasm are still and may long remain matters of conjecture. But it is questionable whether we can here apply the old adage: *De non apparentibus et non existentibus eadem est ratio.* With the acceptance of such a principle science commits intellectual suicide. Vitalism, so far as it implies an alien influx into nature, is sheer metaphysics, and so far as it restricts the operation of some causal agency to the phenomena of life is bad metaphysics. I need hardly say,

however, that it is no part of my thesis to deny in the genesis of protoplasm the manifestation of an underlying purpose. But the manifestation is not restricted to the living cell; it is omnipresent throughout the universe of phenomena. It permeates the whole structure of our experience, both in its objective and subjective reference. And in the latter reference it is postulated in the well-known dictum of Descartes, *Cogito, ergo sum.*

But on the assumption that there is a metaphysical basis for the *cogito*, my own system of related mental sequences is just the one bit of experience in all the world where the nature of the underlying purpose which pervades the universe can stand revealed if it can be revealed at all. The same cause which drives the planets on their course, which sweeps the storm over land and sea, which fashions the frost patterns on the window-pane, which gives sensitiveness to the amoeba and intelligence to the elephant, works in the brain and thought of man. And here alone, in the underlying depths of his own personality, has he an intuition of its nature. If, however, he feels justified in believing that, in the purpose which unifies, directs, and determines the course of his own experience, there is real casual agency, he

can not escape the conviction that it is in constant relation to a wider purpose, *of the same order of being*, but free from his own petty limitations and imperfections.

In the view which I have attempted to set forth, a cardinal feature is that our knowledge is reached by a process of ideal construction. We thus, and only thus, attain to such cognisance of the realities of existence as is possible for us within the limits of human experience. That there is a purpose in nature in relation to our own purpose is an ideal construction: as such it is to be accepted or rejected. But if it be only in the intimations of our own personality that we have any experience of the order of being to which causal activity belongs, our conception of the purpose in nature is so far anthropomorphic. All conceptions in terms of human experience *must* be anthropomorphic, though we may impatiently strive to rid our thought of this fundamentally ineradicable characteristic. Of such a type too is, and must inevitably be, for religious thought, the conception of God. And in every form of Monotheism this characteristic is emphasised in the conception of God as personal. For religious thought, God—God in relation to human experience, God

in so far as we can know Him—is an ideal construction. For the purpose of that thought the ideal construction is specialised, and differs from that of the Absolute as a philosophical conception. And part of this specialisation is the emphasis laid on personality. It is not for me to trespass on the province of the theologian or attempt to show in what ways our ideal construction in the field of religion differs from that which the metaphysician formulates, in his own domain, as the universal cause beneath phenomenal presentations. The two differ in so far as they belong to different universes of experience. The God of Monotheism and the unknowable of a philosophic pantheism, so called, are not the same ideal construction. Into such questions, however, I cannot enter. My point is that, for those who accept the realities of religion as a valid type of human experience, the turning-point of historic evolution—the turning-point of individual development—is that at which man creates God in his own image and sees that He is good. If to some this inversion of the Hebrew text savours of irreverence, they should bear in mind that my thesis has been that it is by such a process of ideal construction we reach, in other fields of thought and experience, the highest and best products of conception, and thus come

into the closest touch to which we can attain, with *the realities and the verities of existence.* Thus only do we approximate to the truth that is independent of us severally and individually.

XII

DETERMINISM AND PURPOSE

THE world around us [said Kant] opens before our view so magnificent a spectacle of order, variety, beauty, and conformity to ends that, whether we pursue our observations into the infinity of space in the one direction, or into its illimitable divisions in the other, whether we regard the world in its greatest or its least manifestations—even after we have attained to the highest summit of knowledge which our weak minds can reach—we find that language in the presence of wonders so inconceivable has lost its force, and numbers its power to reckon; nay, even thought fails to conceive adequately, and our conception of the whole dissolves into an astonishment without the power of expression—all the more eloquent that it is dumb. Everywhere around us we observe a chain of causes and effects, of means and ends, of death and birth; and as nothing has entered of itself into the condition in which we find it, we are constantly referred to some other thing, which itself suggests the same inquiry regarding its

cause, and thus the universe must sink into the abyss of nothingness unless we admit that, besides this infinite chain of contingencies, there exists something that is primal and self-subsistent, something which as the cause of this phenomenal world secures its continuance and preservation.

In our appreciation of this striking passage we must, however, bear in mind that Kant regarded the notion of design or purpose as regulative and not constitutive. We can go no further than saying that, as regulative, the notion permits us to regard all connection beween phenomena *as if* it was the expression of purpose. It is purposive for us; not necessarily purposive in its inner constitution. The best way, it has been said by one of Kant's interpreters, to simplify and systematise our multiplex experiences is to proceed as though such conceptions as that of purpose in nature were valid. We may accept them as postulates, and wonderful order will follow; but we are not entitled to state them as dogmas. We most of us accept, and not least those who pride themselves on being eminently practical and hard-headed, the reality of the things around us as given in sensory experience. But they are realities for the conduct of the affairs of daily life: they are realities for us constituted as we are; they too are

regulative and not constitutive. Practical folks who have taken the trouble to grasp this fact should raise no objection to the contention that reality of purpose in nature is of precisely the same kind. They may deny its existence on other grounds; but on these grounds no valid exception can be taken to Kant's position. We daily and hourly act as if the world around us had a constitutive reality independent of our own experience. And it is unquestionable that we also act as if there were an orderly purpose in the operations of nature to which our own purposes must be adjusted if we would escape disastrous consequences. Fret as we may at the fact, we do not and cannot know the constitutive reality of the universe. But some of us believe that the conception of purpose, as regulative, is for rational thought, not less valid than that of the mechanism through which it finds expression. In any case Kant was definitely of opinion that naturalistic interpretations are, taken by themselves, insufficient. "It is quite certain," he said, "that we cannot adequately cognise, much less explain, organised beings and their internal possibility according to mere mechanical principles of nature." And Lotze, who fearlessly applied the interpretation of naturalism, even within the domain of organic life,

urged that the function of mechanism in the universe is entirely subordinate, and must be regarded philosophically as the instrument of purpose.

Accepting, therefore, the notion of purpose *as a postulate*, as a regulative principle of our thought, the question arises by what right we project it on to the plane of objective existence. In the first place it must be remembered that objective existence is part and parcel of our experience, and that our highest thought is for naturalism but an elaboration of that experience. The question then comes to this: Does purpose underlie and rationalise *our thought and experience?* If it does not, then nowhere does it exist save as a convenient fiction, though a fiction with which we find it difficult to dispense. If it does, then it must underlie the perceptions of daily life and the conceptions of science in their objective reference, that is to say as projected on to the plane of the nature we interpret. In the second place, supposing that we grant that determining purpose is a real factor in human thought, then since that thought is, for naturalism, a product of evolution which is essentially one and continuous, it is only the final term of a purpose that has been operative throughout the whole course of that evolution. It is just because I believe that all that science discloses is the manifestation

of a continuous purpose that I believe that the manifestation is itself continuous, and that the origin of life and mind are ideally capable of explanation in terms of antecedence, coexistence, and sequence.

But what is the criterion of purpose? Let us first consider its manifestation in human life and thought, and as therein susceptible of treatment under the canons of scientific interpretation. A strictly naturalistic discussion of volition, such as that of which we have already given an outline, discloses all the essential features of the process. There is first of all an idea of the end to be attained, and we speak of this as prevision. There is last a presentation of the end as attained. That is all. It is true that between first and last there may be an indefinite number of stages which we speak of as the means by which the end is gradually attained. But every stage is susceptible of a like analysis into an intermediate end first foreseen and then attained. In naturalistic interpretation that is all. Association explains everything. Why the foreseen end should pass into the end as attained we may not ask, or, if we ask, naturalism *per se* affords no answer. It states the observed fact that it is so, such being the inherent constitution of things and thoughts. What then is the essential feature? That the end or sequent is

implicitly contained in the antecedent prevision. This is the naturalistic interpretation of volition. So, too, with our inferences as rational. Dr. Bosanquet has drawn attention to the paradox of inference—that we have not inference unless the conclusion is both necessary from the premises and goes beyond the premises. But it is in the premises implicitly, and goes beyond them only in being rendered explicit. So that here again the sequent is implicitly contained in the antecedent conditions just in so far as determinism holds good. Now I accept such views as sufficient for a naturalistic psychology and logic. But I raise the question whether, granting this to be all that is presented to experience, it is all that is given in experience; whether, granting that this is an adequate analysis of a manifestation of purpose, we are not aware of the underlying purpose as thus manifested. To make my meaning clear I may again quote Dr. Pringle-Pattison's criticism of the naturalistic treatment of volition. In it there is, he says, "first the idea of a movement as in contemplation, and secondly the perception of the movement as executed. In other words, there is a series of happenings somehow passing before us, but no real activity, no real actor in the whole affair." This he contends is incredible, and why? Because the perfectly legiti-

mate method of science in its dealing with the facts of antecedence and sequence as simply given data needs to be supplemented by the conception of agency; the determinate sequence implies, for metaphysics if not for science as such, a determining cause. The whole question resolves itself into, first, the acceptance or not of efficient causation underlying the given antecedence and sequence, and, secondly, if we accept such causal agency as a postulate of reason, our awareness or not of its presence. Here is the point of divergence between different schools of thought. I myself accept the postulate of causation; and I certainly seem (to put it in the least dogmatic form)—I certainly seem to be aware of its operation within my consciousness. But if purpose, as causal, is that of which my volitional sequences are the expression, and if these sequences are continuous with those in evolution at large, then are all sequences throughout the universe the manifestation of purpose.

It will perhaps be said that prevision or foresight is that which is essential to volition; and that human conduct is determined rather by the future than the past. And it will be urged that purpose is inconceivable in the absence of such experience of the past and such prevision for the future. We must

remember, however, that what we call foresight is a condition of the manifestation of purpose in beings constituted like ourselves. The necessity for prevision arises out of the fact that our consciousness is here and now limited to the passing moment in which the effects of past experience, taking form as anticipations for the future, must be present as determinants of action. In other words, the need for prevision is the outcome of human limitations. And is it not one of the paradoxes of human thought that the more perfect the prevision the less of prevision there is? Mozart describes how when he had completed a piece of music he could get the whole of it in a single auditory glance. He did not hear it in his imagination at all as a succession, but in its entirety. And he rejoiced in the hearing of it all at once. Here the consummated purpose was freed from the lets and hindrances incidental to its gradual development. Picture an evolutionist whose knowledge of the past was all-embracing and whose prevision of future events was equally complete. Past and future would coalesce into one glorious present. Time limitations would be transcended in an omnipresent *now* in which the all-pervading purpose would stand revealed and all limitations would be annihilated. If purpose be the underlying reality which

is manifested under the conditions of experience, and if prevision is forced upon us by our own limitations, it can scarcely be maintained that experience as we know it, and prevision as we employ it, are essential attributes of purpose—if by purpose we understand that which characterises an agency which is the source of order in a universe which appeals to our reason as rational.

In accepting the naturalistic interpretation of purposive action, according to which the antecedent idea of the end contains implicitly the sequent attainment of the end, we are accepting the cardinal principle of determinism as formulated by science. But we do so on the distinct understanding that purpose is that which determines. It is the underlying cause of the determinate antecedence and sequence. Science can have nothing whatever to say for or against this postulate—it does not fall within the sphere of science. And here I feel that some apology is due for even a brief reference to so well-worn a topic as that of the freedom of the will. All that I can do is to make it as brief as possible. Science stands for determinism all along the line; determinism alike in the chain of objective experience and in the subjective aspect of that experience; determinism alike in the physical world and in the world

of mental process. For science there is not, and cannot be, such a thing as free will. But is there any antagonism between the determinism of science and the free will of metaphysics, that which implies not merely antecedence but causal efficacy? I conceive that there is none. No doubt freedom and determinism are often regarded as antithetical. The true antithesis of freedom, however, is not determinism but external constraint. My will is free to give expression to its purposes just in so far as I am not thwarted by constraining influences as expressions of other purposes antagonistic to my own. Within these limits I am free to determine; and such freedom cannot be antagonistic to its determinate expression.

But just as the exponents of naturalism steadfastly oppose the introduction of metaphysical links in the midst of a causal chain of determinate sequence (to account, for example, for the genesis of protoplasm or the beginnings of mind), so too, do they refuse to allow free will as a link in the chain of mental phenomena, as these processes are interpreted by a strictly naturalistic psychology. But this the metaphysician who assumes the attitude I have striven to indicate does not suggest. He too, has no sympathy with occasional interference. For him free will is not merely introduced now and again

to help a lame interpretation over a stile. It does not pop in at times of difficulty like the fairy in a pantomime. It underlies the whole course of mental procedure just in so far as this is an expression of individual purpose. Many, it is true, find some difficulty in reconciling such determinism as is demanded by science with human responsibility. But the greater difficulty, as I firmly believe, is that of reconciling responsibility with any other view. On what does the determinism of science rest? Surely on observed uniformity. On what does it rest in the field of human purpose? Surely on the uniform activity of a given character. Just in so far as my purposes form a coherent system, just in so far as my freedom lies in the absence of determination by anything outside the character itself, can you hold me responsible for my acts. Suppose there is no such uniformity, suppose that incoherence takes the place of coherence, so that my acts to-day are no manner of guide to the nature of my acts to-morrow, would my friends not say, "Poor fellow; he is mad; we cannot hold him responsible for any of these acts"? In any case, the strongest personalities that we know, those which most markedly impressed their influence on the world, those of most resolute and most individual will, are just

those who most clearly give expression to uniformity of purpose, and uniformity of purpose is determination in both the technical and popular senses of this word.

It is often urged that it is a characteristic of the tropisms of plants and the lowest animals, and the reflex acts and instinctive behaviour of higher animals, that they appear *as if* the end of the mechanical performance were foreseen, and the same is true of all seeming design in the world of phenomena. But I have urged that this element of foresight, in a necessarily anthropomorphic criterion of purpose, is only forced upon us by human limitations and the conditions of our experience. And I have urged that the essential feature of a manifestation of purpose is that the effect is implicit in the determining conditions—antecedent and sequent ideally coalescing at their present point of contact. But if this be so, then is all evolution and all development, inorganic, organic, and social, just in so far as it is determinate, also and in like degree purposive. There is purpose in the instinctive picking of the newly-hatched chick, though it is not revealed to the consciousness of the bird, which behaves automatically in this way. Naturalism, in the name of physiology, may protest against this conclusion; but, after all,

it is only the converse of that which is reached by naturalism itself. Physiological psychology insists on putting volitional acts into the same category as automatic acts. Dr. Waller, for example, contends that the higher cerebral circuits are of the same type as reflex action. Naturalism asserts that within the ideal construction of physiology they are of the same character. The essential feature is that they both agree in being physiologically determinate. Naturalistic psychology contends that, within the ideal construction of the sequence of mental configuration, determinism rules here also. Metaphysics postulates purpose as the casual agency in the case of human volition. It accepts the principle of determinate continuity, on which naturalism lays so much stress. And it urges that if both cerebral circuits, with their volitional concomitants, and reflex circuits, alike belong to the same category, then if the one be purposive the other also is, for metaphysics, purposive.

For why does the reflex act appear to us to be purposive? Why does it seem to us as if it were guided by foresight? Precisely because it *is* determinate; precisely because, as in human volition, the end is implicitly contained in the antecedent conditions. Long has been the controversy between the

upholders of determinism and those who contend for purpose in nature. No agreement can be reached until both parties realise that they are looking at different sides of the same shield. Determinism, whether in external nature or in human life, is the expression of purpose: purpose is that which finds expression in determinate sequence. The criterion of determinism is that all the conditions of the subsequent event are contained within the antecedent configuration; and this, according to naturalism itself, is just that which accepts darkness as the characteristic feature of human volition and purpose. Either, therefore, purpose has no existence at all, or it is that of which all determinate sequence is the phenomenal expression.

My aim has been to show that a belief in purpose as the causal reality of which nature is an expression is not inconsistent with a full and whole-hearted acceptance of the explanations of naturalism, within their appropriate sphere. At the outset I contrasted two modes of interpretation—that which works outwards from human life as a centre, and explains the world in terms of purpose analogous to the purposes of man, and that which works inwards from external mechanism to that of the human brain,

with its associated mental states, and explains the universe in terms of natural law. At the close I reach the conclusion that it is not impossible to bring these views into harmony, if we can accept the postulate that determining purpose is the reality which underlies the determinate course of phenomena. Each is supplementary to the other. Neither can be substituted for the other within the same universe of discourse. We may not interpolate purpose in a scientific curve of antecedences and sequences, just to fill in the gaps due to our present ignorance of physical and psychological conditions. Nor may we interpolate inorganic or organic mechanism within the curve of purpose, save as a manifestation of that causal existence which gives uniformity and continuity to the course of events.

Except for passing reference near the beginning of this discussion I have been obliged to leave on one side that which I spoke of as the æsthetic appeal. A separate essay would be needed for its further consideration. That it only attains to its highest value and worth when it is associated with an interpretation of nature in terms of purpose is my firm conviction. The æsthetic appeal, like the appeal of purpose, is essentially projected from the thoughts, feelings, and emotions of man on to the plane of

external nature. Only if we accept this process as, in its appropriate sphere, at least as valid, for interpretation, as the naturalistic process of reducing everything to mechanism, can the appeal be regarded as coming to us from a purpose beyond the confines of our own subjectivity. On this deeper plane of interpretation, just as for the thinker all nature is instinct with reason, so too, for the poet, does the whole universe "tremble with song." As the poet from whom I borrow this expression—Mr. William Watson—sings it:—

Lo, with the ancient
Roots of man's nature
Twines the eternal
Passion of song.

Ever love fans it,
Ever life feeds it,
Time cannot age it,
Death cannot slay.

Deep in the world-heart
Stand its foundations,
Tangled with all things,
Twin-made with all.

Nay, what is nature's
Self, but an endless
Strife towards music,
Euphony, rhyme?

Trees in their blooming,
Tides in their flowing,
Stars in their circling,
Tremble with song.

God on His throne is
Eldest of poets;
Unto His measures
Moveth the whole.

The most valuable production since Darwin's "Origin of Species."

The Nature of Man

Studies in Optimistic Philosophy

By Élie Metchnikoff

Professor at the Pasteur Institute

Translated with an Introduction by

P. Chambers Mitchell

Secretary of the Zoölogical Society

Octavo. Illustrated . . . Net, $2.00

It is not often that a scientific book may be read with ease, profit, and pleasure by the general reader, so that M. Metchnikoff's book comes in the nature of an agreeable surprise. It is marked by a refreshing *naïveté* and a large simplicity which are characteristically Russian. The scientific importance of this work is so great that it is spoken of in England as the most valuable production since Darwin's *Origin of Species.*

Opinions of the Press

"An extremely interesting and typical book. . . . With a distinguished frankness, M. Metchnikoff defines his attitude to our universal prepossessions. It is his theory that the infirmities of age are to be overcome. If there be ground for this conception, humanity is to be profoundly changed and what we call life now, will be the childhood and youth of that longer and larger life."—H. G. WELLS, in *London Speaker.*

"Undoubtedly a great book (in some quarters it has been hailed as the greatest since Darwin's famous message to the world) and should be read by all intelligent men and women."—*The Nation.*

"A book to be set side by side with Huxley's Essays, whose spirit it carries a step further on the long road towards its goal."—*Mail and Express.*

New York—G. P. Putnam's Sons—London

" One of the classics of the nineteenth century."

The Evolution of Man

A Popular Scientific Study

By Ernst Haeckel

Professor at Jena University

Translated from the Fifth (enlarged) Edition by

Joseph McCabe

Two volumes, 8vo, with 30 Colored Plates and 512 other Illustrations, together with 60 genealogical tables . . Net $10.00

The work is a comprehensive statement of the scientific grounds for evolution as applied to man. It does not deal with religious controversies, and is scientific throughout. The work is unique in design, which is carried out in the last edition with the highest degree of Haeckel's literary and artistic skill. Haeckel has always been distinguished for pressing the combination of the evidence from embryology with the evidence of zoölogy and paleontology. In the present work he devotes one volume broadly to embryology, or the evolution of the individual, and the second to the evolution of the human species, as shown in the comparative anatomy, zoölogy, and paleontology. The last few chapters deal in detail with the evolution of particular organs right through the animal kingdom: the eye, ear, heart, brain, etc. Every point is richly illustrated from Haeckel's extensive knowledge of every branch of biology and his well-known insistence on comparative study.

The work is written for the general reader, all technical terms being explained, and no previous knowledge being assumed ; but the scientific reader, too, will find it a unique presentation of all the evidence for man's evolution, and especially as a study of embryonic development in the light of race-development.

In this edition, to which Haeckel gave six months' hard work, the plan is carried out with great skill, and the illustrations are very fine. All the most recent discoveries in every branch of science involved are included. It is a thoroughly up-to-date, non-controversial, most comprehensive, and scientific treatise on the evolution of man by the greatest living authority on the subject.

New York—**G. P. Putnam's Sons**—London

The Argument against Materialism

Life and Matter

A Criticism of Professor Haeckel's

"A Riddle of the Universe"

By Sir Oliver Lodge

Crown 8vo. $1.00 net. By mail $1.10

The author fully acknowledges Haeckel's service to scientific thought in introducing Darwinism into Germany, and he admits that to advanced students Haeckel's writings can do nothing but good. He believes, however, that to some general readers they may do harm, unless accompanied by a suitable qualification or antidote, especially an antidote against the bigotry of their somewhat hasty and destructive portions.

"Deserves to rank with the best contributions by Huxley to scientific literature; while from the scientific standpoint it is timely in its appearance, brilliant in its conception, and admirable in execution. It should be welcomed by all who are interested in the development of true science, but who have no patience for blatant materialism. . . The utterance of a scientist eminent for his wonderful researches. . . . The book is full of interest and information."

Rev. James M. Owen, Lynchburg, Va.

"A fascinating reply to Haeckel's materialistic philosophy of life. The arguments are sane and sound. Lodge is a profound scientist, but he does not allow his scientific knowledge to obscure his general judgment."

Providence Journal.

New York—G. P. Putnam's Sons—London

By ISABELLA BIRD BISHOP

The Yangtze Valley and Beyond

An Account of Journeys in China, chiefly in the Province of Sze Chuan, and among the Man-Tze of the Somo Territory. With map and 116 illustrations from photographs by the author. 2 vols., octavo $6.00

"The author has travelled over part of the country [China] about which very little is known and about which she has many strange facts to relate. She is a keen observer . . . and her literary style is, on the whole, straightforward. The illustrations are excellent . . . and are thoroughly descriptive of the scenes they are intended to represent. . . . The present work forms a fitting supplement to the long series of narratives previously published by this plucky and intelligent traveller." — *The Athenæum.*

"We are greatly indebted to Mrs. Bishop for these charming and instructive volumes. The work will rank with her other great books on Japan and Korea, and aside from its broad and liberal views on Chinese internal and foreign affairs, it is unquestionably the best sustained narrative and the most valuable work that has yet appeared dealing with the Yangtze and the populous province adjacent to the river."—*N. Y. Times Saturday Review.*

Unbeaten Tracks in Japan

An Account of Travels on Horseback in the Interior, including visits to the Aborigines in Yezo, and the Shrines of Nikkô and Isé. With map, 42 illustrations, and glossary, 2 vols. in one, octavo. $2.50

"Miss Bird is one of the most remarkable travellers of our day. We doubt whether the inner life of Japan has ever been better described than in the pregnant pages of this pertinacious Englishwoman."—*N. Y. Tribune.*

G. P. PUTNAM'S SONS

NEW YORK LONDON

GENERAL THEOLOGICAL SEMINARY
NEW YORK

BD 581 .M67 1906
Morgan, C. Lloyd 1852-1936.
The interpretation of nature

GENERAL THEOLOGICAL SEMINARY
00023228